

# consulting engineer

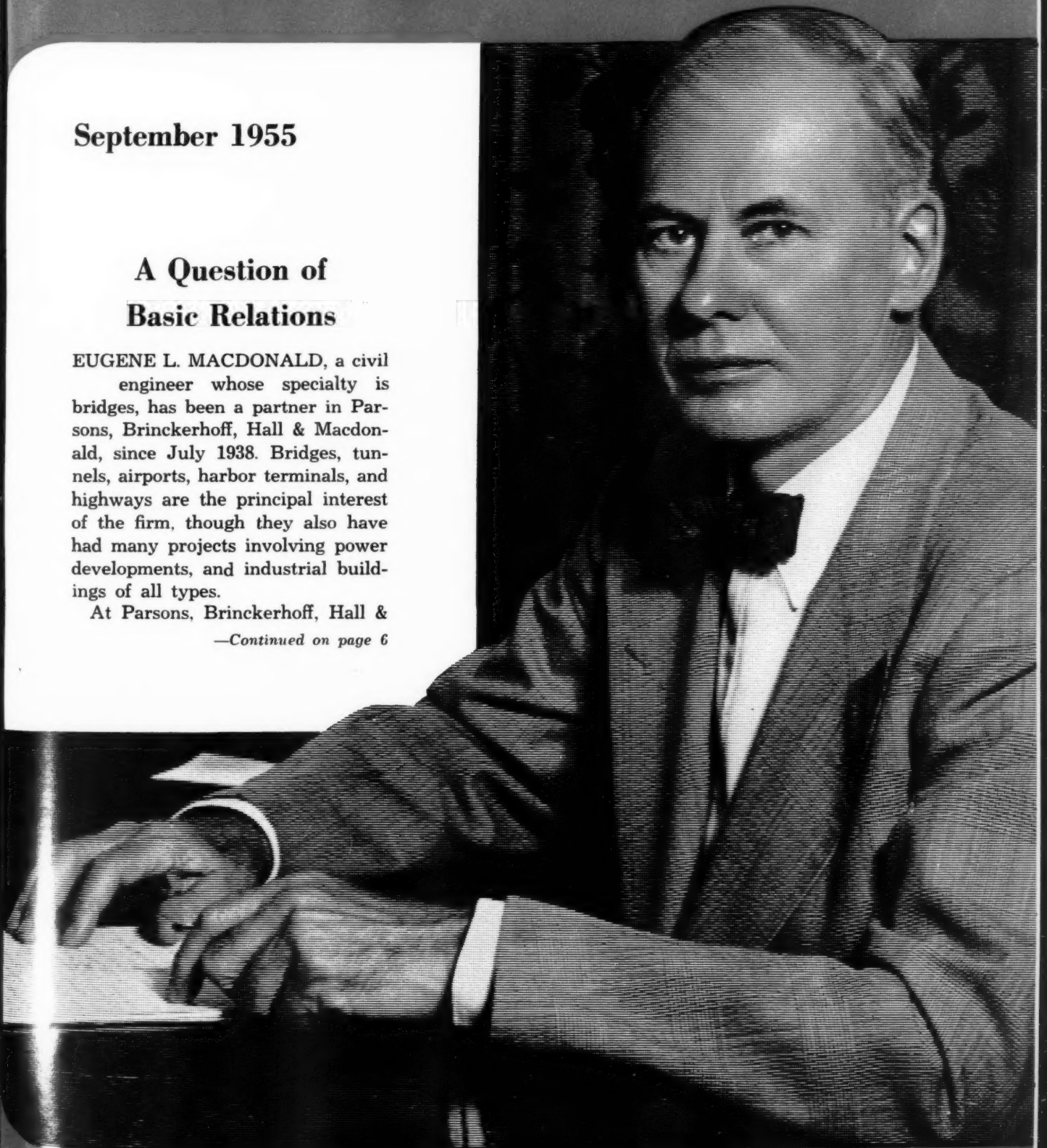
September 1955

## A Question of Basic Relations

EUGENE L. MACDONALD, a civil engineer whose specialty is bridges, has been a partner in Parsons, Brinckerhoff, Hall & Macdonald, since July 1938. Bridges, tunnels, airports, harbor terminals, and highways are the principal interest of the firm, though they also have had many projects involving power developments, and industrial buildings of all types.

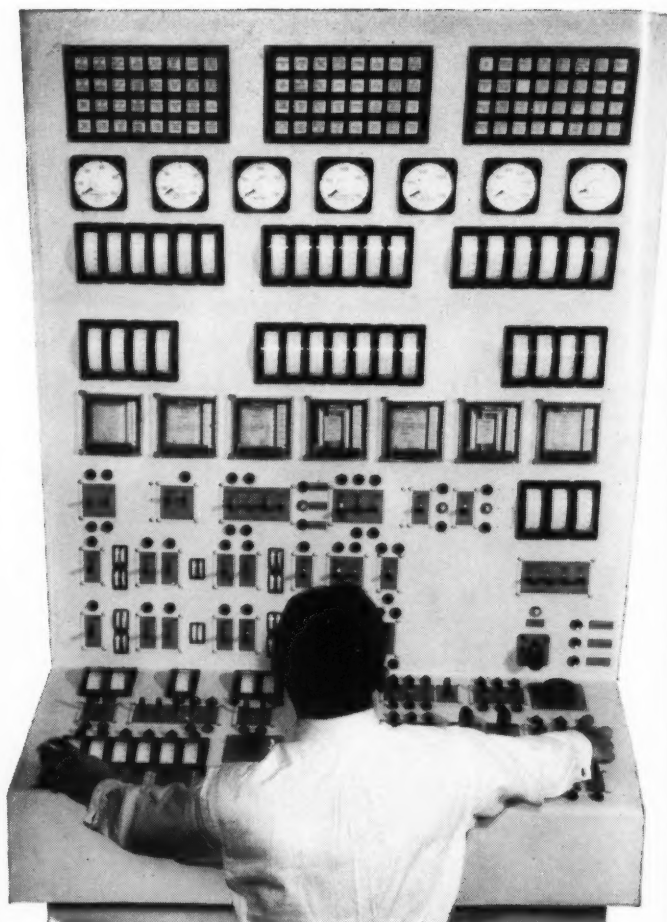
At Parsons, Brinckerhoff, Hall &

—Continued on page 6



*The Consulting Engineer's Professional Magazine*

# NEW DIMENSIONS in boiler plant instrumentation



**Controlling a giant boiler, turbine, and generator from a panel 4 feet wide!**

At Ninemile Point Plant of the Louisiana Power and Light Company, the new third unit is controlled by the unusually compact B.T.G. control panel shown here. The B.T.G. (Boiler-Turbine-Generator) panel built by Hays is an innovation of Ebasco Services, Incorporated.

Practically every detail of the third unit of Louisiana Power's new Ninemile Point generating plant is of the newest design. An all-weather outdoor boiler with Hays electric type combustion control—gas fired, with provisions for "stand-by" oil firing—will produce over 1,000,000 lbs. of steam per hour, superheated and reheat to 1,005°F.

On outdoor boilers electrically operated combustion control is especially preferred because it doesn't require expensive compressors and dryers, allows maximum freedom in control room location. For greater speed of response and accuracy new Hays electronic instruments, including electronic mercury-less flowmeters and 3 element electronic feed water control are being installed.

Among the central stations recently selecting Hays instrumentation and control are: Jersey Central Power and Light Co., Northern Indiana Public Service Co., Central Illinois Electric and Gas Co., St. Joseph Power and Light Co., Crawfordsville Power and Light Co.

*Write for Hays Boiler Plant  
Instrumentation Bulletin 54-605-83.*

**hays**  
CORPORATION

MICHIGAN CITY 32, INDIANA

Automatic Combustion Control • Vortiflow Meters and  
Variflow • Electronic Oxygen Recorders • CO<sub>2</sub> Recorders  
Boiler Panels • Gas Analyzers • Combustion Test Sets  
Draft Gauges • Electronic Flowmeters • Miniature  
Remote Indicators • Electronic Feed Water Controls



# consulting engineer®

VOLUME 6 NUMBER 3



Published by



Consulting Engineer Publishing Co.  
227 Wayne St., St. Joseph, Mich.

## EDITORIAL

Hunter Hughes

A. M. Steinmetz

J. C. Dean

D. L. Wolf

F. D. Hirschfeld—Zurich, Suisse

## ART

Len Sentowski

Jack Knuth

## PUBLISHER

E. R. Gauley

## BUSINESS MANAGER

F. C. Donohue

## CIRCULATION

Viola Coulombe

## SALES MANAGER

O. DeWitt Young

## SALES REPRESENTATIVES

(See page 108)

The Engineering Index Service in Public Libraries lists articles from CONSULTING ENGINEER

CONSULTING ENGINEER is published monthly at 227 Wayne St., Saint Joseph, Mich. Price 1 year \$10.00; foreign \$15.00; single copy \$1.00. Accepted as Controlled Circulation Publication at Saint Joseph, Michigan. Send Form 3579 to Saint Joseph, Mich. Copyright 1955 Consulting Engineer Publishing Co.

## September 1955

### FEATURE ARTICLES

Engineers and Professional Recognition .....	42
<i>C. W. Griffin, Jr.</i>	
Permanent Magnets — A Staff Report .....	47
... history and theory .....	47
... metallic oxides — old materials in new forms .....	50
... a basic concept — varying the magnetic force .....	52
... latches, hitches, holding devices .....	55
... clutches, brakes .....	58
... magnetos, induction generators .....	60
Specifying Canned Motor Pumps .....	62
<i>Staff Report</i>	
The Geneva Atomic Conference .....	67
<i>Fritz Hirschfeld, European Editor</i>	

### DEPARTMENTS

Personality — Eugene L. Macdonald .....	Front Cover
Readers' Comment .....	10
Scraps and Shavings .....	18
Economic News Notes — E. F. MacDonald .....	22
Atoms in Action .....	28
The Legal Aspect — Melvin Nord .....	34
News .....	82
Report From Britain — Fritz Hirschfeld .....	86
Men in Engineering .....	94
Notes From Abroad .....	96
Books .....	102
Meetings .....	106
Advertisers' Index .....	108

*The Consulting Engineer's Professional Magazine*

SEPTEMBER 1955

5

## Eugene L. Macdonald

—Starts on front cover

Macdonald, a partner is much more than a name on a letterhead. At that firm each partner is actively in charge of several projects with each project engineer reporting directly to him.

"This does not mean," Macdonald points out, "that the project engineer is simply a man who follows orders. Our project engineers are completely capable of handling their jobs alone, but they make use of the experience of the partners. The ideal partner is the kind of engineer who can give advice rather than specific directions. The combination of capable direction by the project engineer backed up by experienced guidance from the partner results in the type of professional work of which we are proud.

"This policy limits the number of projects we can take to the job load that can be handled by our partners. We cannot afford to get too big. The consulting firm that operates beyond the limits of personal interest by the partners runs the risk of becoming a business rather than a professional organization. That we never intend to do.

"The only way to grow and remain professional is to add more partners. Seventy-five years ago, when this firm started, there was just one principal, William Barclay Parsons. Currently, there are eight, of which I am now the only one whose name is in-

cluded in the name of the firm. As time goes on, we will need more partners—younger men to replace those of us who retire and perhaps others to permit us to expand our operations.

"Many firms are complaining about the salaries that must be paid for young men just out of engineering school. Actually, \$400 a month is a bargain price for the right man. For the wrong man any price is too high—but if we can hire a future project manager or a future partner for \$400 a month, we are the gainers. So the important factor is not the price but the man.

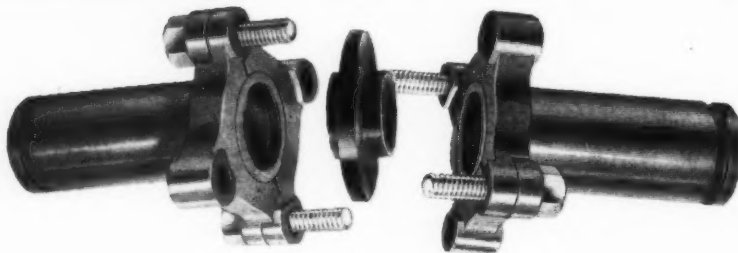
"If you hire the right men, carry them through a few years, and then lose them to another organization, you have lost a real investment. We try to avoid that by doing everything possible to develop initiative and a sense of responsibility as quickly as possible. Then, we let the men share in the rewards that result from a job well done. We also believe in financial recognition for the young engineer who has handled a job in such a way that it has pleased the client and resulted in a better job at a lower price.

"Employment must be mutually beneficial. The employer and the employee both must know that they are gaining from their agreement to work together. There is nothing sacred about the agreement. Loyalty is a fine thing, but it has nothing to do with the basic employment agreement. If the employed engineer can do better somewhere else,

# Gaco

## RUBBER-LINED SYSTEM

### SIMPLIFIES YOUR PIPING PROBLEMS . . .



The GACO split flange is the ultimate in engineering simplicity. Pipe is prepared for joining by grooving ends and counterboring rubber lining. Rubber gasket is fitted into the pipe ends. Split flanges are wrapped around grooved pipe section and bolted together to complete the assembly of the GACO joint. The GACO System is adaptable to any type of rubber-lined pipe installation.

*Save time and reduce costs on piping installations and repairs.  
Write for a copy of GACO Rubber Lined Pipe System catalog today.*

**GATES ENGINEERING COMPANY • WILMINGTON 99, DELAWARE**

#### 1. ELIMINATES DESIGN ENGINEERING . . .

Rubber-lined pipe can be cut to size and installed at the job site from a sketch of the installation.

#### 2. 360° ROTATION . . .

Flexibility of the free turning GACO split flange principle assures that every installation will line up on the job. The GACO flange hole pattern rotates around the pipe, conforming to all standard, rubber-lined fittings.

#### 3. FOUR WAY SEALING . . .

GACO rubber gasket has a four-way sealing feature, giving leakproof service up to 1600 pounds pressure and 28" vacuum.

#### 4. UNINTERRUPTED FLOW . . .

The GACO joint presents uninterrupted flow to the liquid stream through the entire GACO pipe system.

## BEFORE YOU BUY A PACKAGE BOILER

# CHECK THIS LIST!

If you need a package boiler, the list at the right can give you some interesting answers. Of course, C-E's Type VP Boiler rates a "yes" answer to every question. It offers also many other operational advantages, such as simple, effective soot blowing; high heat absorption; low draft loss, no dead gas pockets and simple baffle arrangements.

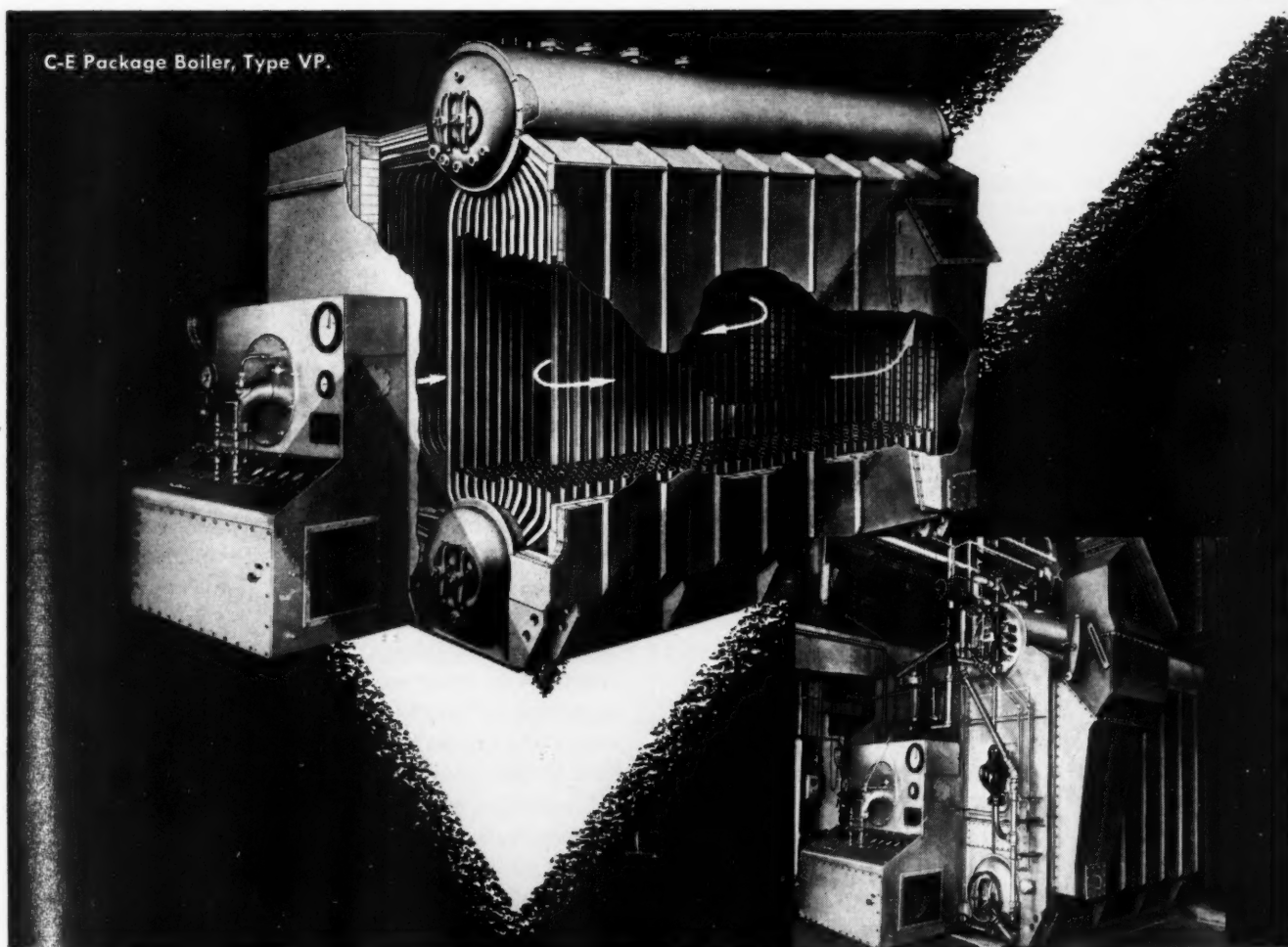
That's why VP purchasers range from small companies to some of the nation's largest — plus schools, institutions, government agencies, including the Atomic Energy Commission. These users employ VP Boilers for all types of applications — heating, process, even power generation.

### SPECIFICATIONS OF THE VP BOILER

Capacity — 4,000 to 40,000 pounds of steam per hour  
Pressures — up to 500 pounds per square inch  
Fuel — oil or gas  
Erection — completely shop-assembled  
Foundation — simple concrete slab.

Have full details on the VP next time you are in the market for a boiler of moderate capacity. Get the new Catalog VP-258, which contains specifications, and information on dimensions, construction details and controls. B-845A

	BOILER					
	A		B		C	
Will your boiler be a real "package" type with control panel and all controls mounted integral with the boiler?	Yes	No	Yes	No	Yes	No
Will your package boiler be equipped with drum internals to assure dry steam?						
Will its "steam quality" be backed with a guarantee?						
Will your boiler have a 30-in. lower drum to provide convenient accessibility?						
Will yours be a one-burner boiler, with a simple wiring and control system?						
Will your boiler have the largest load swing range available?						
Will your boiler be equipped with a quiet centrifugal fan?						
Will your furnace be completely water-cooled?						
Will your furnace have the highest ratio of water cooled surface to furnace volume?						



## COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.



BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS AND FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE



## Let's talk PUMPS...



### for **YOUR** specific purposes!

Pumps become an intensely personal subject . . . when you find that certain types or makes can provide the kind of trouble-free service you need—thus saving you from expensive shut-downs!

When you talk pumps, consult a WEINMAN Centrifugal Specialist. He's the man with the know-how and experience to diagnose your particular problem and provide the kind of answer you want most . . . a pumping system tailored to your industrial requirements . . . one that renders year-in and year-out dependability, with minimum maintenance required . . . and yet keeps initial costs low.



The WEINMAN General Service Unipump—ideal for limited-space applications where liquids must be handled efficiently and economically.

WEINMAN Centrifugal Pumps are built by Centrifugal Experts . . . with long years of experience in the design and manufacture of centrifugal pumps to supply every industrial need . . . from small to large capacity in both low and high head models, and handling of all types of liquids even those carrying solids. Solve your pump problems today—write, wire or phone your nearest WEINMAN Centrifugal Specialist.

Representatives in principal cities

**WEINMAN**

Pump Mfg. Co.

he should go. The employer has no right to expect him to stay with the firm out of loyalty if more is offered him in another job. This is equally true in reverse—if the employer can do better, he should. As soon as the relationship ceases to be mutually beneficial, it should be terminated.

"This simply emphasizes the importance of selecting the right man in the first place and giving him the opportunity and the encouragement to advance as fast as he is capable. Incidentally, the right man seldom needs encouragement, only opportunity.

"Employee relations is only one part of the job. Client relations are equally important. Here, again, price is important. Just as in the employer-employee contract, the contract between client and consultant must be mutually beneficial. We do not think such a relationship is likely if the project is awarded on a bid basis. We negotiate all of our contracts, and we would never consider competing for a job on a price basis with either open or closed bids.

"Actually, the price a consultant charges does not necessarily reflect quality. More likely it reflects the work load on the firm and the desire for the job at hand. Experience in the field is also an important factor. Some firms will take a job at a very low figure just to get the experience. I cannot blame them for that. After all, they have to get started some way, and how can a new firm compete against a well established group with a good reputation unless they cut the price? The price cutters to be condemned are those who do less work for the client . . . the firms that quote a low price and then turn the work over to the equipment manufacturers and contractors. For example, on a highway bridge project, the consultants can do the engineering work in detail and turn over final drawings to the bridge company for them to make shop drawings incorporating all of the consultants' ideas. On the other hand, the consultant could simply make preliminary drawings and leave the engineering details to the bridge company. Naturally, one consulting fee would be a lot below the other. Also, the client would lose in service when the consultant failed to give the project all the benefit of his engineering knowledge.

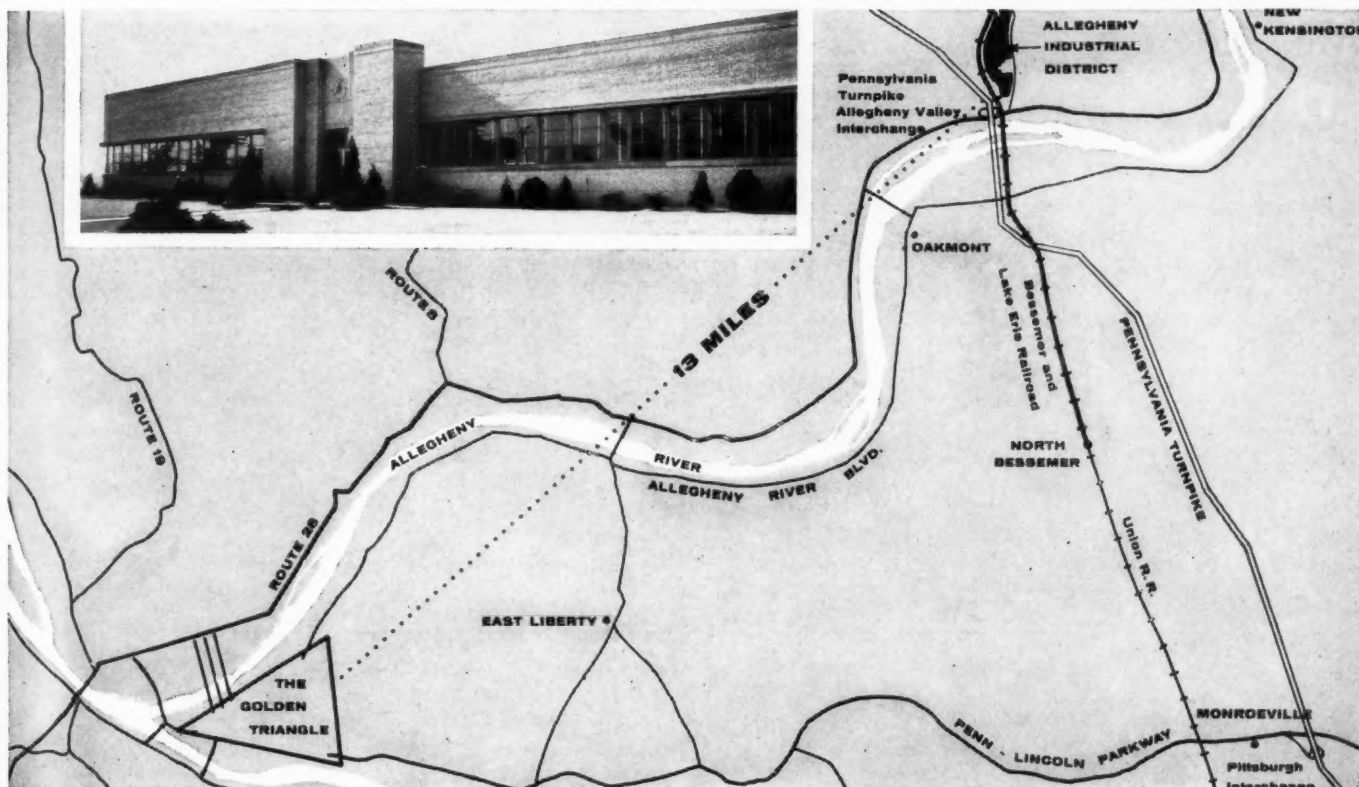
"The trouble is that when the client pays attention to price only, he never knows whether he is getting a bargain simply because the consultant wants the experience or whether he is getting a shoddy job involving a minimum of engineering.

"Actually, getting the job is nothing more than a combination of reputation, ambition, energy, and selling ability. All of these but one are equally available to all consultants. If reputation is the only one missing, that can come in time.

"Profit for the consulting firm comes, then, from the fulfillment of two mutually beneficial contracts, the contract with the employee and the contract with the client; contracts fulfilled by engineering knowledge combined with honor and dignity." ▲ ▲

CONSULTING ENGINEER

# Plan a Modern Plant in the New Allegheny Industrial District



In PITTSBURGH's first railroad-sponsored planned industrial development, you'll enjoy . . .

- **A STRATEGIC LOCATION**

Bessemer & Lake Erie rail service . . . interchange connections with all six major-area rail systems . . . proximity to Allegheny Valley Interchange of Pennsylvania Turnpike.

- **FLEXIBILITY OF BUILDING LAYOUT**

- **HARMAR TOWNSHIP'S LOW REAL ESTATE TAX**

- **EXTRA ROOM FOR EXPANSION**

- **ADEQUATE OFF-STREET LOADING AND EMPLOYEE PARKING**

- **ALL UTILITIES**



Bessemer & Lake Erie Railroad, Industrial Development Division  
P. O. Box 536, Pittsburgh 30, Pa.

Please forward your brochure on  
"ALLEGHENY INDUSTRIAL DISTRICT" to:

NAME \_\_\_\_\_  
COMPANY \_\_\_\_\_  
STREET \_\_\_\_\_  
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_



### "Good Friend and Supporter"

Sir:

The August, 1955, issue of *CONSULTING ENGINEER* with the article, "Scraps & Shavings," contains a reference to the National Electrical Contractors Association being among the worst offenders in the offering of free engineering service to the public. This article cited a page advertisement in *Time* costing "something over \$9,000 . . . to tell how their members (electrical contractors) can handle electrical engineering work without charge."

I would appreciate if you would send me this "page" advertisement in *Time* containing this offer. I believe that I had something to do with the ads we carry. Our files show no such insertion.

I believe that the record will show that NECA has for more than 50 years been a very good friend and supporter of the electrical consulting engineer and has gone out of its way to give him identity and help him. Many of our members employ engineers and some are licensed engineers along with their construc-

tion work. Most certainly we do not promote or suggest that our members make a practice of offering engineering services without charge in competition with the consulting engineer. We are not interested in giving anything away.

Apparently this undeserved criticism of NECA arises from an unrealistic definition of "engineering." We have and still promote the services of our members including the services of installation (or construction) engineering. That is a customary and proper function of the qualified electrical contractor. It is something quite different from the function of design engineering which we regard as the province of the independent consulting engineer and certainly is his proper function when competitive bids are involved.

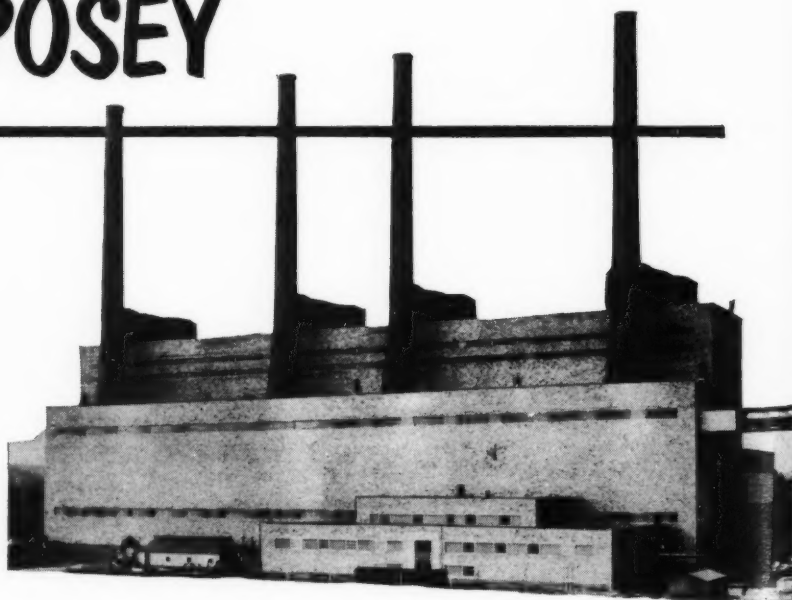
Perhaps your concern comes from a fractional page ad in *Time* in which the services of installation engineering was offered the home owner or the small commercial customer on electrical modernization. Whenever an electrical contractor goes into a home to balance the circuits or add an outlet or two, he does engineering. Do you have a list of consulting electrical engineers in every hamlet and cross-

## STACKS by POSEY

These four huge self-supporting steel stacks were fabricated and erected by Posey Iron Works for an eastern power station. Each stack measures 23'6" at the base, 12'6" at the top, and is 192' high.

For any stack job, large or small, Posey offers complete design, fabrication and erection facilities. Your request for information or estimates will be answered promptly, cheerfully and without obligation.

*Steel plate fabrication by Posey meets all standard codes, including ASME, API-ASME and API.*



ELEVATED TANKS • HORIZONTAL TANKS • STACKS  
PRESSURE VESSELS • DIGESTERS  
CARBON STEEL AND ALLOY STEEL PLATE FABRICATION  
DREDGE PIPE AND ACCESSORIES

## POSEY IRON WORKS, INC.

Steel Plate Division

Lancaster, Penna.

New York Office: Graybar Bldg.

Established Since 1910



# good boiler insurance!"



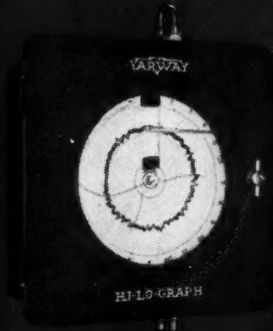
## YARWAY WATER GAGES

Flat glass, high pressure type shows features new separated-design inset and type "M" illumination that causes water level meniscus to "shine like a star". Described in Yarway Bulletin WG-1812.



## YARWAY REMOTE SIGNAL ALARMS

Lights on horns, operated by Control Unit on Yarway Indicator, give instant warning of any serious deviation from normal water level. Can be located anywhere in plant. Described in Yarway Bulletin WG-1824.



## YARWAY HI-LO-GRAPH RECORDER

Gives a continuous 24-hour record of liquid levels. Actuating mechanism is same as in Yarway Indicator. Used both for indicating and recording. Described in Yarway Bulletin WG-1830.



## YARWAY TELEVISION

Simplified system consists of compact camera and panel-mounted monitor. Clear, bright image of water level gage anywhere in the plant. Described in Yarway Bulletin WG-1813.

# steam plant equipment

BLOW-OFF VALVES

WATER COLUMNS AND GAGES

LIQUID LEVEL INDICATORS

EXPANSION JOINTS

STEAM TRAPS

STRAINERS

SPRAY NOZZLES

DIGESTER VALVES

# Designed to fit the space

## and the need!

### *"Buffalo"*

#### HEATING, VENTILATING AND FRESH AIR UNITS

Here's complete flexibility and assured results in planning your heating, ventilating and makeup air installations. Compact, narrow "Buffalo" Highboy units can easily be mounted on the floor next to walls. Where floor space is at a premium, "Buffalo" Lowboy suspended units provide accurate, efficient heat distribution over any desired floor areas. All models available with filters and bypass dampers. "Buffalo" swivel outlets permit accurate aim of air stream, and the "Buffalo" mixed-flow fans are so stable in performance that long duct runs may be connected to the outlets. WRITE FOR BULLETIN 3704A for full details, including handy diagrams and tables showing you exact models to choose for any results you desire. Write today!

**WALL-HUGGING HEATER** for close-quarter jobs like the installation above. Note sectional construction for easy installation and servicing.

**HEAT WITHOUT REDUCING FLOOR SPACE!** Below, a "Buffalo" Flat Suspended Lowboy keeps a warehouse warm and dry without reducing storage space.

**HEATS — VENTILATES — FILTERS!** Highboy unit equipped with filters, dampers and mixing chamber. Extended outlets have horizontal and vertical louvers. Also available in a flat suspended window unit for makeup air.

#### BUFFALO FORGE COMPANY

147 Mortimer Street

BUFFALO, N. Y.

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities

VENTILATING	AIR CLEANING	AIR TEMPERING	INDUCED DRAFT	EXHAUSTING
FORCED DRAFT	COOLING	HEATING	PRESSURE BLOWING	

roads of America ready and able to go out on \$10 and \$50 trouble calls to "engineer" the installation of an outlet and do so at a fee the homeowner would pay?

That is what NECA is talking about and I am a bit amazed that this situation is not obvious to anyone in the industry.

George B. Roscoe  
Director of Public Relations  
National Electrical Contractors  
Association  
Washington 6, D. C.

● CE WAS WRONG, MR. ROSCOE RIGHT, THE AD WAS 1/3 PAGE RATHER THAN A FULL PAGE.

Counter from Cleveland

Sir:

Have you read the advertisement on page 104 of the July 18th edition of *Time* magazine? . . . It is an example of the prevalent practice of Public Utilities, Electric Equipment Manufacturers, and Electrical Contractors offering so-called free engineering services to the public.

This practice is contrary to all State Professional Engineering Laws, and I would appreciate reading how your editorial staff suggests we should cope with this very serious threat to the operations of the consulting engineer engaged in private practice.

James L. Sherwin, P.E.  
Cleveland, Ohio

A National Reaction

Sir:

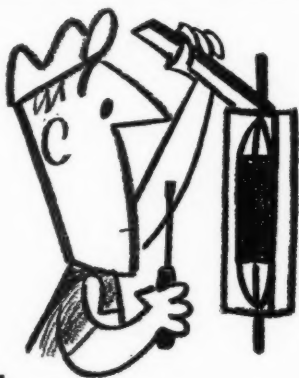
Your article in the August issue regarding Consulting Engineers' practice is most excellent and it will prove effective in our campaign to promote the interests of our profession. We believe our October 28 meeting [of consulting engineers in St. Louis] will kick-off a national reaction among others in the field which can produce a most desirable result for those affected by the practice of consulting engineering.

I want to congratulate you on the masterful and comprehensive way you have guided this publication from its beginning down to this time. I am fortunate to claim the distinction of being one of your first issue subscribers. It is one of my most valuable publications, and I read it thoroughly for those items interesting to me each month. Your selection of articles surely should satisfy the full cross-section through the profession.

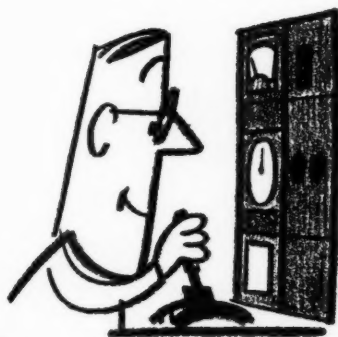
Hueston M. Smith, President  
Smith-Hanlon-Zurheide-Levy Inc.  
St. Louis, Mo.

CONSULTING ENGINEER

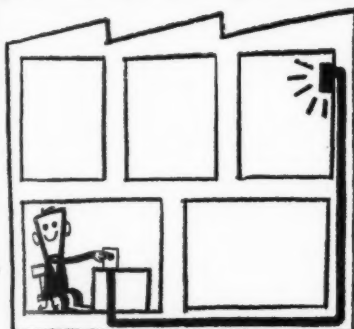
# I-T-E Circuit Breaker Protection



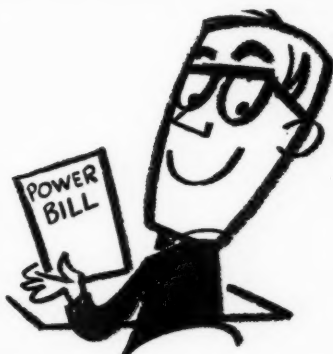
**4** They are completely tamperproof. Breaker is calibrated and sealed at the factory.



**5** They are twice-tested individually at the factory to insure uniformity of operation in the field.



**9** They can be equipped with internally mounted auxiliary devices for under-voltage protection, remote tripping and indication of circuit condition.



**10** They incur low watts loss. Welded connections and silver alloy contacts provide low watts loss throughout the life of the breaker.

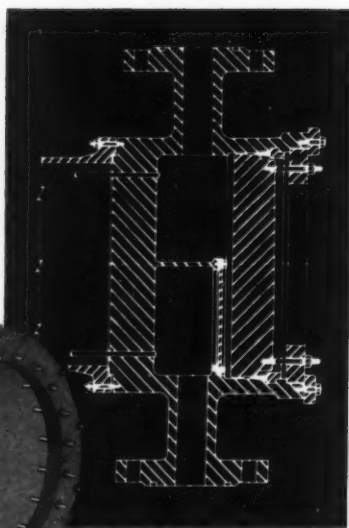
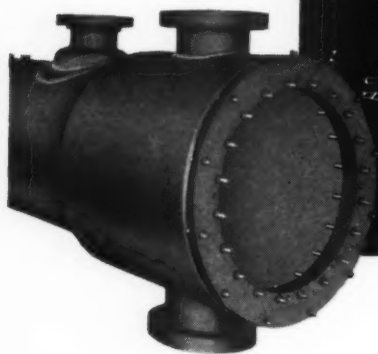
I-T-E Molded Case Circuit Breakers are rated through 600 volts a-c, 250 volts d-c, 10 through 600 amp. I-T-E also supplies a complete line of enclosures for all applications. Contact your I-T-E representative or authorized distributor for the Speedfax Catalog. Or write Small Air Circuit Breaker Division, I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Philadelphia 30, Pa.



**I-T-E CIRCUIT BREAKER COMPANY • Small Air Circuit Breaker Division**



## "PRES-SEAL" CONSTRUCTION



## for High Pressure Service

This unique "Pres-seal" front closure makes Whitlock Feed Water Heaters ideal for high pressure service in industrial power plants or central stations. It eliminates heavy cover bolting since the hydrostatic load effects its own seal. The channel and tube sheet . . . a single forging . . . readily withstand the full range of pressures to 3,000 psig.

High pressure extraction heaters, in U-tube or straight tube constructions, are available in standard designs suitable for combinations of desuperheating, condensing, and sub-cooling. Send for complete details. The Whitlock Manufacturing Co., 96 South Street, West Hartford 10, Conn. New York, Boston, Chicago, Philadelphia, Detroit, Richmond. Authorized representatives in other principal cities. In Canada: Darling Bros., Ltd., Montreal.

# Whitlock

Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.



## SCRAPS & SHAVINGS

AT THE END OF NEXT MONTH there will be a meeting in St. Louis — a meeting of importance to all consulting engineers. On October 28, representatives of several state and regional associations of consulting engineers will get together at the Jefferson Hotel for a dinner meeting—this followed by a full-day session on Saturday, October 29, plus as much as is needed of the Sunday following.

The associations specifically invited to send representatives to the meeting are the Consulting Engineers Association of California, Minnesota, Washington State, Texas, Ohio (now being formed), New York City, and Chicago. The American Institute of Consulting Engineers has also been invited to send a representative. Two other groups, the Consulting Engineers Association of Oklahoma, and the Missouri Association of Consulting Engineers will act as hosts at the meeting. Any engineers planning the formation of an association in their state or metropolitan area also are invited (urged, in fact) to send representatives.

### Purpose of Conference

The purpose of the conference is to discuss mutual problems and to consider the formation of a federation of the state and city associations now in existence. It is the current feeling of the host groups (Oklahoma and Missouri) that a loose federation, or council, in which the associations held membership (rather than individuals), would be desirable. Each state or city group would still be left free to operate as it saw fit and to maintain its membership requirements, constitution, and by-laws as local conditions required.

It is interesting to note that one of the associations invited to the meeting does not seem to fit into the scheme of things. The American Institute of Consulting Engineers is already a "national" organization. What interest could they have in the organization of another national association of consulting engineers?

They should have a very great interest! In our opinion, if the American Institute of Consulting

POWELL VALVES ... THE COMPLETE QUALITY LINE ... POWELL VALVES

... THE COMPLETE QUALITY LINE ... POWELL VALVES ... THE COMPLETE QUALITY LINE ...

# POWELL STEEL VALVES



FIG. 11323—1500-Pound  
Motor Operated Steel  
Pressure Seal  
Gate Valve



FIG. 11365—Steel Pressure  
Seal Horizontal Lift Check Valve  
For 1500 Pounds W.S.P.

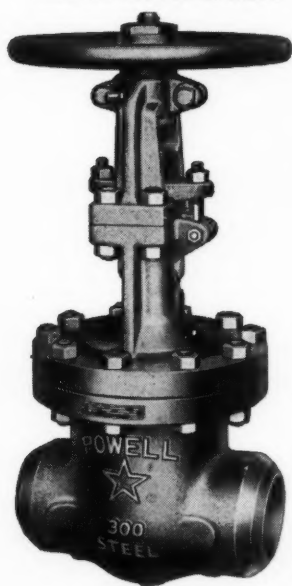


FIG. 3003 WE—Steel Gate  
Valve For 300 Pounds W.S.P.



FIG. 1314-A—1500-Pound  
Integral Bonnet Steel  
"Y" Valve

... THE COMPLETE QUALITY LINE ... POWELL VALVES ... THE COMPLETE QUALITY LINE ...

POWELL VALVES ... THE COMPLETE QUALITY LINE ... POWELL VALVES

Wherever flow requires dependable control, there's the place for Powell Valves. Powell can supply just the valve you need, for Powell probably makes more kinds of valves and has solved more valve problems than any other organization in the world.

Shown above are just a few Powell Steel Valves. Investigate their many outstanding features ... and the complete line of quality valves famous for dependable service.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help solve any flow control problem you may have. Write ...

The Wm. Powell Company,  
Cincinnati 22, Ohio ..... 109<sup>th</sup> year

Engineers had not confined its activities so closely to New York City; if they had encouraged an enlarged membership; if they had supported the organization of state and city chapters, taking in the already formed associations, there would be no need for the October meeting in St. Louis. On the other hand, it seems that the AICE has always taken pride in its small membership (about 250), apparently feeling that this limited number gives an exclusive and almost honorary flavor to the organization. Actually, their basic requirements for membership do not differ materially from those of the state and city associations now in existence. All of them require that their members be engaged solely in the practice of consulting engineering to the exclusion of contracting or manufacturing.

#### National Organization Needed

In an article in the January, 1955, issue of *CONSULTING ENGINEER* we called attention to the failure of AICE to meet the needs of consultants for a national organization and concluded that "If the American Institute of Consulting Engineers does not grab the ball soon, their fumble will be recovered by some other group. . ." It looks as though the fumble will be recovered in St. Louis.

While we have long recognized the need for a truly national organization, we are sorry that AICE did not fill the need, itself. It is a fine organization made up of qualified and distinguished engineers. But they refused to recognize that Manhattan Luncheon Meetings are not enough for a national organization. It is unfortunate that still another name will have to be added to the list of engineering organizations. There are more than enough now.

When there is a need, however, the need must be filled, and there is no question but that the engineers in private practice need an organization to provide a means through which they can solve mutual problems involving competitive bidding, unfair competition, setting of fees, and other aspects of professional ethics and operation facing only those engineers in private practice.

What will come of the St. Louis meeting we do not know. But the intent is good, and the opportunity is there to form a strong, affiliated association such as exists in Europe. This might, in fact, be a first step toward eventual affiliation with the International Federation of Consulting Engineers, the group to which the consulting engineering associations of ten European countries belong. ▲ ▲

## WHY YOU CAN SPECIFY NAGLE PUMPS WITH UTMOST CONFIDENCE!

Nagle Centrifugal Pumps are designed and constructed exclusively for the dirty, gritty, ravaging, abusive jobs—for pumping slurries, slimes, tailings, ashes, drainage, corrosive liquids or hot liquids. You are safe in specifying them

*because*

- ✓ They are used by many "blue chip" mining, chemical, petroleum, and manufacturing companies.
- ✓ They are designed to eliminate bearing and stuffing box troubles.
- ✓ They are tailor-made of materials best suited for each particular application—manganese steel, Ni-Hard, ABK Metal, Hastelloy, etc.
- ✓ Vertical shaft and horizontal shaft types in wide range of sizes and capacities.
- ✓ We like to work with consulting engineers. Send for Catalog 5206.

# NAGLE PUMPS



PUMPS FOR ABRASIVE AND CORROSIVE APPLICATIONS

**NAGLE PUMPS, INC.**  
1223 CENTER AVE., CHICAGO HEIGHTS, ILL.

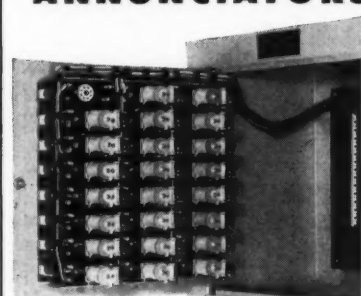
TYPE SW-OB



TYPE  
CW-OC

TYPE T

## KIRKLAND ANNUNCIATORS



MLBR-2200-KK, 24 Sections, rear view.



Individual MLBR section with relay. Engraved message is back-lighted.

Consider for example our type MLBR-200. When the supervised contacts become abnormal the audible signal is sounded and the engraved message is lighted in red and white. Toggle operation cuts off audible and lights message in red. When contacts restore to normal, the audible is again sounded automatically and the message is lighted in white. Toggle operation removes the audible signal, and lamps.

ILLUMINATED MESSAGE AREA 2" W. x 1" H. Individual boxes molded of bakelite, (3 3/4" x 1 1/2"), with PLUG-IN relay in rear. Systems for voltages to 250 V. AC or DC. Attractive prices.

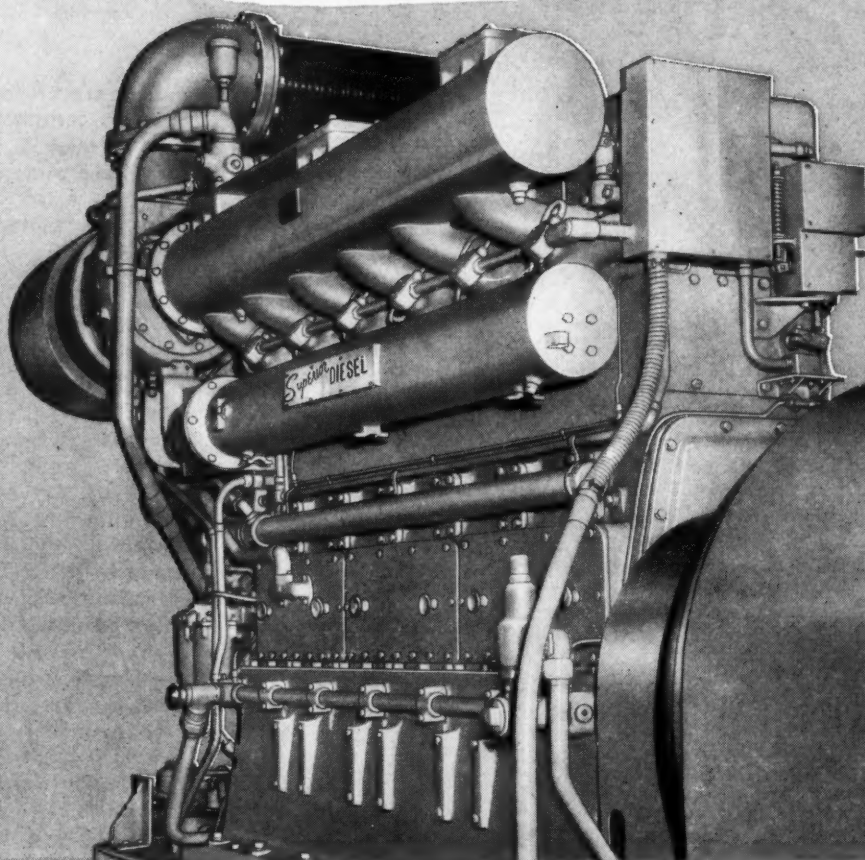
**THE H. R. KIRKLAND CO.**  
MORRISTOWN, N. J.



see how

# Superior or Atlas Engines

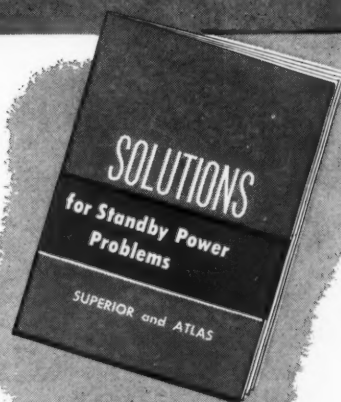
solve your standby power problems



Model 40 Superior Engine-Generator Set, an engineered installation, solves standby power problems of an Ohio company.

Engineered installations of Superior and Atlas Diesel, dual fuel and gas engine-generator sets have solved hundreds of standby power problems! In many cases they've paid for themselves. Their automatic start and stop operation often averts tragic consequences, by providing efficient, dependable power for essential plant services in every instance of main power source failures. In order for you to have all the facts and figures we've prepared a special case history file. It shows many instances of how our skilled engineers assisted in solving serious problems involving special considerations and peculiarities in individual installations. Chances are many of the installations will be similar to yours. This information will prove a valuable aid in your planning.

Write, on your letterhead, requesting this file of helpful examples. White's skilled engineers, with years of experience in developing engineered installations of Superior or Atlas engine-generator sets, will assist you in engineering the proper standby power for your specific requirements.



## WHITE DIESEL ENGINE DIVISION

THE WHITE MOTOR COMPANY • Plant and General Offices: Springfield, Ohio





**E. F. Mac Donald**  
INDUSTRIAL ECONOMIST

# ECONOMIC News Notes

**ENGINEERING EXPERT** — Each year the International Road Federation sponsors a year of graduate study in this country for at least 15 highway and traffic engineers from foreign countries. The year's program includes special lectures and lab courses, on-the-job observation and training at highway projects, and visits to highway equipment manufacturers and to state highway departments. Each student is required to complete a research project in some phase of highway or traffic engineering especially applicable to his own country.

**LATEST LOW-DOWN** — The most recent survey of the perennial plaint of a shortage of engineers discloses that research and development programs in general are not being held up by shortages of engineers and scientists. The survey of 200 companies by the National Science Foundation does show that shortages of such personnel are a problem in the aircraft and electric equipment industries.

**MOCK-UP** — Last month the Connecticut General Life Insurance Co. opened for public inspection a full-scale mock-up of one section of a proposed \$10 million office building. The purpose of the 60 x 72 ft. structural model was to pre-test materials and methods to be used in the real thing. So far, various types of lighting, ceilings, floor coverings, partitions, windows, decorating schemes, and equipment have been tested in the mock-up.

**ONE-PACKAGE PLAN** — A new method for leasing construction equipment has been announced by The Morrison Plan, Inc., Buffalo. The arrangement provides a one-package deal for users of heavy construction and railroad maintenance equipment whereby they can lease on a long-term basis different types of equipment from different manufacturers in one transaction.

**PLASTIC PROSPECT** — Monsanto has undertaken a study of the applicability of all plastic materials to construction uses. Its newly created Structural Plastics Engineering Group will try to determine what feasible uses there are for plastics in the construction industry and how

to adapt plastics to such uses. The idea is to find ways in which plastics may be used to do certain building jobs better than older materials can do them or, used in conjunction with them, to improve current materials and uses.

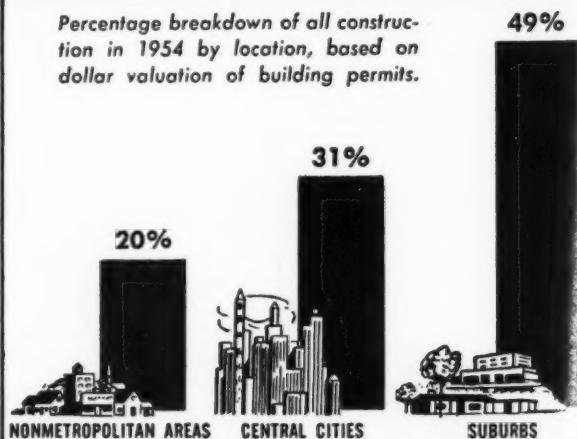
**ANOTHER ONE** — The newly created Florida Development Corporation will help industry to locate in Florida by making available long-term loans at low interest rates. As in most other state development corporation setups, banks in the state will participate.

**PLANNED COMMUNITY-HOOD** — A tract of 15,000 acres in the Lakehurst—Toms River area of Ocean County, N. J. will be converted into a residential area of 200,000 inhabitants. Located an hour and a half's drive from New York City on the Garden State Parkway, which the community will straddle, the new cities will have earmarked locations for industrial development, schools, municipal buildings, recreational facilities, and shopping centers. The developers, the Lane Realty Co., Forest Hills, N. Y., have a 10-year plan for two proposed municipalities.

**SIGNIFICANT SHIFT** — Nearly one-half of all the building permits issued last year were for construction in the suburbs of the nation's metropolitan areas. As shown in the chart, only about 30% of 1954's construction was put in place in central cities. Construction data released by the Departments of Commerce and Labor show that the trek to Suburbia now includes much more than people—construction of new factories, shopping and recreational facilities, service establishments, and other kinds of non-residential building are becoming an important part of a broad centrifugal movement.

## OUR BOOMING SUBURBS

Percentage breakdown of all construction in 1954 by location, based on dollar valuation of building permits.



SOURCE: Bureau of Labor Statistics

Prepared by Institute of Life Insurance

## Selection of high-bay mercury lighting answers need for long-range power economy

Pontiac's decision to use ventilated high-bay mercury lighting in its new press plant means this:

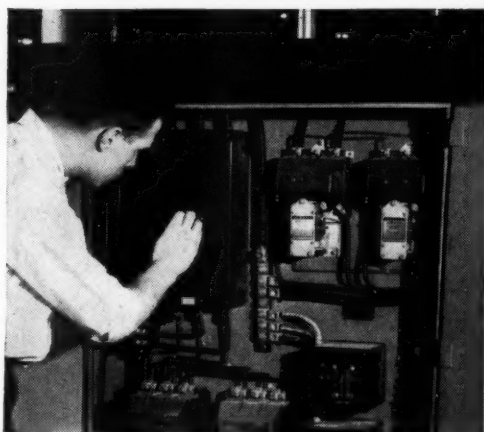
Better quality control—under any production setup—as well as long-range power economy.

Probably the world's largest 1000-watt mercury lighting installation, Westinghouse luminaires provide an average of 60 footcandles for the 440,000-square-foot production area. Yet the lighting consumes only 3.3 watts per square foot.

And these rugged Westinghouse units are virtually maintenance free. Air circulating through an opening between the neck and reflector sweeps the reflector surface clean—exceptionally practical when you consider the mounting height is 40 feet above the production area.

DP-5016-E

YOU CAN BE **SURE**...IF IT'S  
**Westinghouse**



Westinghouse control board automatically switches over from mercury to stand-by lighting whenever electrical faults may occur. Once the power is restored, a timing relay holds on the stand-by lighting for the duration of the mercury preheat cycle.



1290 Westinghouse ventilated high-bay luminaires deliver 60 footcandles to the working area—over 40 feet below. The aluminum high-bay reflectors shield the mercury lamps from observers through a 32-degree angle zone.

*Architects and Engineers:* Albert Kahn Assoc., Detroit, Mich.

*Electrical Contractor:* J. Livingston & Company, Inc., Detroit, Mich.



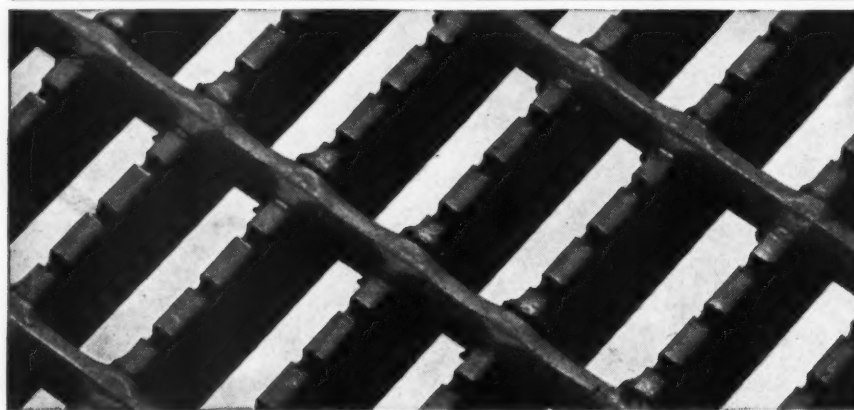
# ATOMS IN ACTION

PENNSYLVANIA IS LEADING in central station power reactor projects. Duquesne's Shippingport Plant is well under way, and now Pennsylvania Power & Light announces a privately financed homogeneous reactor power plant of at least 150,000 kw, scheduled for completion in 1962. Again Westinghouse will work on the design and supply the reactor and generating equipment. Plant will be located in Eastern Pennsylvania. This, like the Consolidated Edison project, will not involve the use of government funds. Heretofore, Westinghouse has concentrated on pressurized light water reactors. This will be their first effort in connection with a homogeneous reactor design. Looks like a change in thinking of the top brass of Westinghouse Atomic Power Division.

THE BIG NUCLEAR NEWS this month comes from Geneva. For on the spot coverage of the trade exhibit in the Palais des Exposition, by our European Editor, see page 67 of this issue of CONSULTING ENGINEER. Great Britain had the largest exhibit in this commercial

show, with twenty-eight exhibitors. France had an even greater number of exhibitors (50), while the United States had twenty-four. It is generally agreed that General Electric, with a model of the Commonwealth Edison plant, and Union Carbide, with a model of a homogeneous reactor had two of the most impressive exhibits. In the early days of the exhibit, attendance was slow, but more of the delegates found a little free time as the Conference progressed and attendance picked up.

A FAIRLY FULL DESCRIPTION of the Shippingport Plant was presented to the Conference in a paper co-authored by representatives of Westinghouse, Duquesne Light Co., and the AEC. The paper stated that the plant will be fueled by 12 tons of natural uranium surrounding 115 pounds of enriched uranium seed. The plant is expected to be in operation, delivering 60,000 kw by 1957. The reactor will have 24 control rods, will be 33 ft high, and 9 ft in diameter. The water to the heat exchanger will be at 2000 psi and at a temperature of about 525 F.



**Gary**

**New Slip-Proof Design makes  
SERRATED GRATING safest  
WHERE GOOD TRACTION IS IMPORTANT**



**FREE SAMPLE**  
We'll send this handy paper weight if you request it on your company stationery.

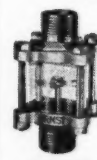
**Standard Steel Spring Division**  
ROCKWELL SPRING AND AXLE CO.  
4015 East Seventh Avenue • Gary, Indiana

Indoors or out, for area gratings in sidewalks, inclined walkways, fire escapes—wherever safe-footing is important, this one-piece, resistance-welded grating will provide safer working conditions. It's tailor-made to your requirements. Write for descriptive Catalog CE-95

## ERNST

**SIGHT FLOW INDICATORS**  
"See What Goes On Inside"

For insertion into pipe  
**FOR EVERY APPLICATION**  
BRONZE, IRON, STEEL,  
STAINLESS STEEL



**FIG. 29**  
Cylinder with  
Impeller



**FIG. 17-28**  
Cylinder



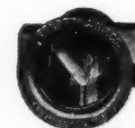
**FIG. 215**  
Flanged



**FIG. E-57**  
Double  
Window



**FIG. 212**  
Visibility  
Welding  
Neck or  
Screw



**FIG. E-811**  
Flapper



**FIG. E-1816**  
Rotating Wheel Type

All sizes up to 6"

Send for Catalog

**ERNST WATER COLUMN & GAGE CO.**  
LIVINGSTON, N. J.

# A Big Reason Why More Firms Are Switching to Copyflex . . .

**PROBLEM-FREE  
INSTALLATION  
and  
OPERATION!**



Model 93

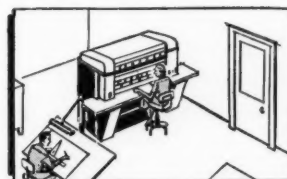
Because Copyflex reproduction machines are completely free from fumes and odors, they require no exhaust venting . . . they need no plumbing or auxiliary equipment, no installation other than an electrical connection.

Because they are absolutely clean, quiet, and odorless, they can be operated *anywhere* without annoyance to personnel in the vicinity.

That's why the people who handle reproduction, and know it best, prefer Copyflex. It's a big reason why more and more firms are switching to Copyflex!

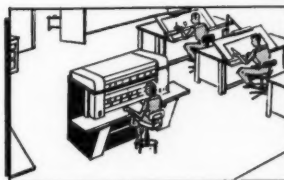
Why settle for less when it costs no more to own the one machine that offers you *all* the advantages of diazo-type, positive black-on-white reproduction—speed . . . economy . . . quality—*plus* trouble-free installation and ideal operating conditions!

You'll find that Bruning also gives you the widest selection of reproduction materials available anywhere. Mail coupon for information on models and prices—today!



**PUT IT HERE . . .**  
Near an inside wall—  
no plumbing, no ducts!

**PUT IT THERE . . .**  
Near an outside wall—  
no vents in walls, windows!



**PUT IT ANYWHERE!**  
Needs only an electrical  
connection for operation!

## BRUNING

Best Process! Best Machines!  
Best Selection of Materials!

## Copyflex

Specialists in Copying Since 1897

Charles Bruning Company, Inc., Dept. 93K.  
4700 Montrose Ave., Chicago 41, Ill.

Please send me information on Copyflex  
Reproduction Machines.

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

CHARLES BRUNING COMPANY, INCORPORATED • 4700 MONTROSE AVENUE • CHICAGO 41, ILLINOIS

SEPTEMBER 1955

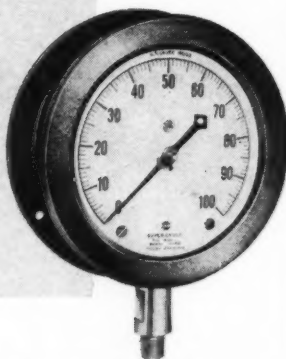
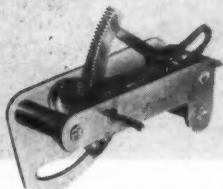
31

**NEW!**



# SUPERGAUGE®

with exclusive  
**ARC-LOC**  
MOVEMENT



- With proper application this new Supergauge will last a lifetime!
- Legend on dial gives complete description of gauge construction. Maintenance engineer can pick proper gauge from his stock.
- Nylon-faced stainless steel segment with stainless bushed bearings give lifetime service!
- For your convenience  
**MONO-UNIT CONSTRUCTION** Permits easy removal of complete gauge assembly for inspection and adjustment.
- **ARC-LOC MOVEMENT** Provides complete and rapid adjustment from rear without removal of dial.

MICROMETER ADJUSTABLE SELF-LOCKING POINTER

Above features are also available in USG Solfrunt Gauges with solid front construction.

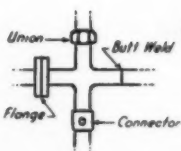
**UNITED STATES GAUGE**

*Gauge Headquarters*  
for over 50 years

United States Gauge, Division of American Machine and Metals, Inc., Sellersville, Penna.

## THE NEW STANDARD IN PIPELINE ECONOMY

### Speedline® STAINLESS STEEL FITTINGS SIMPLIFY PIPELINE DESIGN!



FITTING IS ADAPTABLE . . . YOU SELECT THE TYPE OF JOINT

- Simple layouts require fewer design hours
- Versatility permits reduced inventory
- Expanding feature saves time, money . . . eliminates need for costly tools



Details of the greater design flexibility possible with Speedline Fittings—at lower cost—are contained in this new illustrated catalog. Write for a copy today. There's no obligation.

© SPEEDLINE is a registered Horace T. Potts Co. trademark

Distributors are located in principal cities from coast to coast

**Speedline** STAINLESS STEEL FITTINGS

manufactured by **HORACE T. POTTS COMPANY**  
522 East Erie Avenue • Philadelphia 34, Pa.

The turbine will operate at 1800 rpm and steam will be at 545 psig saturated. It is estimated that the plant can be brought up to full capacity after a total shutdown in about 3 1/2 hours—against 5 1/2 hours for a conventional plant.

THE CONFERENCE, itself, was considered a great success. Perhaps one of the most important reactions will be a loosening of currently classified information by the AEC. It has been felt by the press that the AEC has been waiting for this Conference to let out a lot of formerly classified information of non-military nature. This was not all withheld until now simply to make a big splash at the Conference. Our Atomic Energy Commission also wanted to see what the other nations admitted to knowing before spilling all of our pool of data.

NEXT BIG ATOMIC MEETING will be in Washington, Sept. 27-29. This will be a combination of a meeting of the Atomic Forum, Inc. with the first U.S. Trade Fair of the Atomic Industry. The Forum meeting will concentrate on commercial and industrial aspects as well as international developments. Coming just a few weeks after the Geneva Convention, this will be the first opportunity for a group of independent experts to evaluate and summarize the results of the Conference. There is also a much greater interest in the Trade Fair than would have been anticipated on the basis of past exhibits. Many of the major suppliers of equipment for atomic industry will show their wares. The meeting will be at the Sheraton-Park.

GENERAL DYNAMICS CORP. has joined the growing list of American business firms to add an Atomic Division. Theirs will be headed by Dr. Frederic de Hoffman, who will be assisted by Gordon Dean, former AEC Chairman. They are building a \$10 million laboratory for nuclear research. The principal objective of the early research work will be directed toward bringing down the price of reactors by simplifying designs and increasing efficiency.

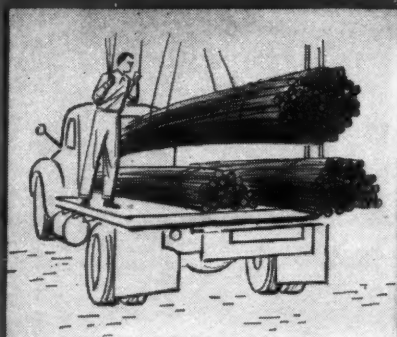
UNION CARBIDE has also taken the step. A new company, Union Carbide Nuclear Company, has been formed as a division of UCC. Kenneth Rush will be president. UCC has been active in the atomic energy program since its inception. They designed, engineered, and operated the K-25 plant at Oak Ridge. This plant has been under UCC management since 1945. They also operate the gaseous diffusion plant at Paducah. The new division will consolidate all of UCC's atomic energy activities, from uranium mining surveys to development of special materials for nuclear engineering, in one organization.

LIKE TO EXPERIMENT? Price has been announced by the AEC for several raw materials required for reactor operation: heavy water . . . \$28.00 per pound; enriched (20%) uranium fuel . . . \$10,000.00 per pound; natural uranium . . . \$40.00 per kilogram. The heavy water is a bargain—Norsk Hydro is quoted at \$90.00.

THE GERMAN GOVERNMENT has decided to pursue actively a development program for non-military applications of atomic energy by building an atomic reactor and research laboratory in the city of Karlsruhe. The experimental station will consist of one or more reactors, an institute for neutron physics, a chemical laboratory, and a series of workshops specializing in electronics. The estimated cost of the station is approximately \$6.5 million. It is expected that the project will be headed by Dr. Werner Heisenberg, Nobel Prize winner and present head of the Max Planck Institute for Physics.

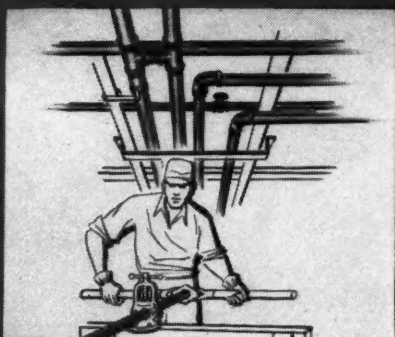
CONSULTING ENGINEER





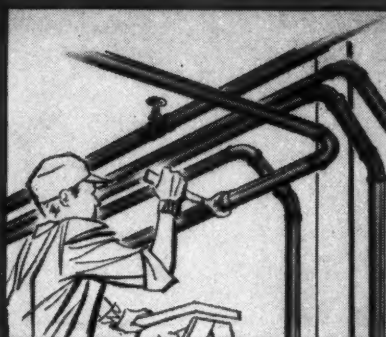
### 1. Cost of Pipe

The important thing about this cost is that it represents only *one small part* of the piping picture and should not establish the only pipe comparison guide.



### 2. Cost of Installation

This cost generally represents the *major part of the piping investment* and includes labor, fabrication, valves, fittings, covering, and overhead.



### 3. Cost of Maintenance

This is the money paid to keep the piping system in operation as long as the need for it exists. The amount spent depends largely on the quality of pipe used.

# 3

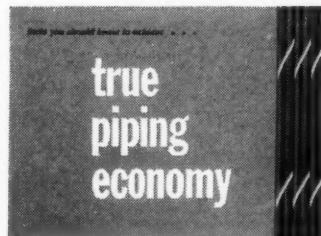
## IMPORTANT COSTS THAT SHOW WHY WROUGHT IRON PIPE PROVIDES TRUE PIPING ECONOMY

This breakdown of piping system costs underscores the reasons why wrought iron pipe users enjoy maximum piping economy even though they pay more, *initially*. These users know that they buy an *installed piping system*, not just the pipe. And because the greatest cost of this installed piping system is in labor, valves, fittings, fabrication, covering, and overhead, the difference between the cost of the wrought iron installation and what a low-first-cost pipe installation would have been, shrinks to an insignificant amount in the cost of the *total piping contract*.

But still more important to the plans and pocket-books of wrought iron pipe users is the Cost of Maintenance. One user put it this way. "A wrought iron installation is like having money in the bank." He was simply expressing wrought iron's longer

service in terms of money saved in repairs, replacement, and maintenance. There's no doubt about it . . . when you consider the three costs, you can buy the best—wrought iron—and get a bargain at the same time.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N. Y. Available throughout the world.



### Write for Booklet

The booklet, *True Piping Economy*, gives detailed information on the cost facts presented here, plus many others. You will find it a valuable guide in placing pipe selection emphasis where it will profit you most.

# BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON  
**WROUGHT IRON**  
TUBULAR AND HOT ROLLED PRODUCTS  
ELECTRIC FURNACE QUALITY STEEL PRODUCTS



# *the Legal Aspect*

MELVIN NORD

Consultant in Legal and Technical Problems

Registered Professional Engineer

Patent Attorney



. . . The Effect of Legislation on Labor Law

IN THE LAST three columns we have traced the development of labor law by judicial decision. As pointed out, labor law was administered by the courts as "common law," but actually there was no common law ready-made, and it had to be invented by the judges as they went along. The labor unions generally felt that the judges were unconsciously prejudiced in favor of their own "class" and against the unions. Certainly, labor law is a subject charged with a great deal of emotion, and it has always been a political as well as a judicial problem.

For a long time it has been evident that the ultimate solutions to the problems of labor law ought to be provided by the legislatures, acting according to the wishes of the citizens. And, as organized labor grew in political power, pro-labor legislation began to appear, including the Clayton Act, the Norris-LaGuardia Act, and the National Labor Relations Act. Later, the pendulum began to reverse, in the Taft-Hartley Act. State statutes have also been passed, often paralleling federal statutes.

## **Federal Anti-Trust Laws**

The first Federal Anti-Trust Law—the Sherman Act—was passed in 1890. Its object was to regulate business combinations that were acting in restraint of trade in interstate commerce. It was not directly related to the labor movement, but it indirectly affected it, since the courts regarded many labor activities as analogous to business monopolies or as otherwise restraining trade.

The second Federal Anti-Trust Law—the Clayton Act—was passed in 1914. In addition to clarifying and reinforcing the regulation of business as provided in the Sherman Act, the Clayton Act specifically provided that "the labor of human beings is not a commodity or article of commerce," and that a labor monopoly was not illegal. The language of the act was apparently broad enough to legalize vir-

tually all labor activities, and the courts were so much as ordered not to enjoin such activities. The clear implication seemed to be that labor was henceforth not to be regarded as analogous to business, and courts were not to "invent labor laws."

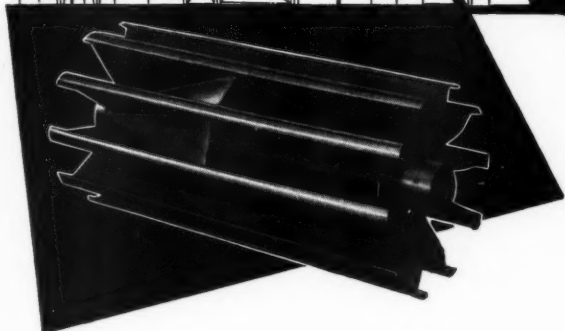
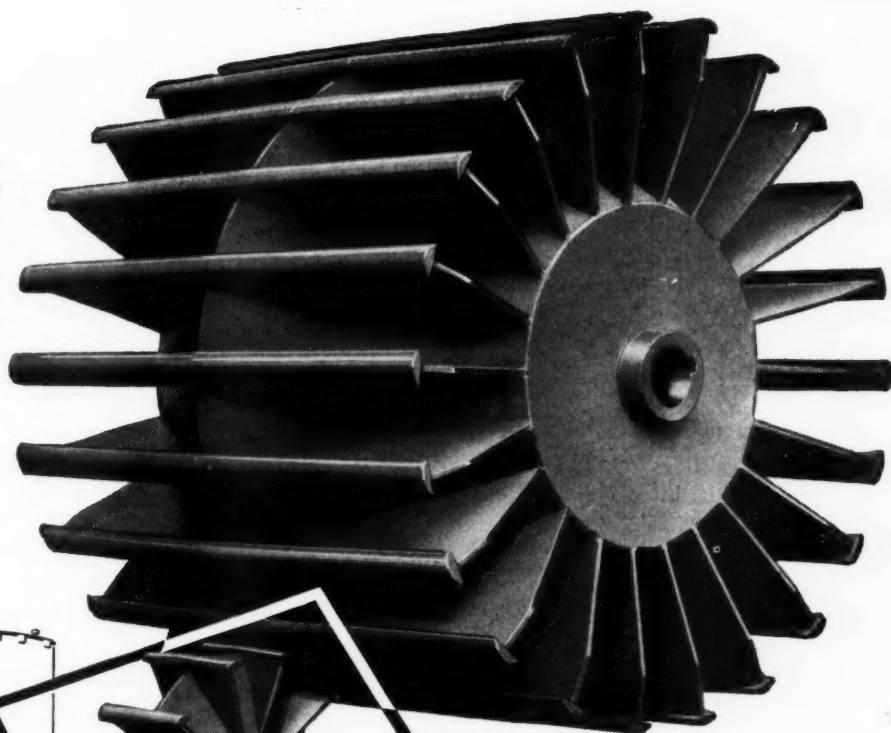
The impact of this legislation, insofar as the development of labor law is concerned was much less than what might have been expected. The judges took a rather dim view of the broad statements embodied in the Clayton Act, taking the position that it merely prevented the courts from enjoining labor activities that were lawful under the existing "common law," i.e. under their recent decisions. The effect, therefore, of the Clayton Act on labor law has not been great.

## **The Norris-LaGuardia Act**

In 1932, Congress passed the Norris-LaGuardia Act, and in many states so-called "little Norris-LaGuardia Acts" were also passed. These Acts prohibited the courts from enjoining any labor dispute in which the participants had an economic interest—even though not directly as employer-employee. Secondary strikes, jurisdictional strikes, strikes for the closed shop, peaceful picketing, and strikes against technological change, were all included, at least by implication though not by name. Nor could the courts enjoin a union from inducing employees from breaching a so-called "yellow dog contract" by which they had promised not to join a union while in the company's employment. However, it was held that sympathetic strikes and secondary consumption boycotts were not in the category of non-enjoinable labor activities. Nor were activities that involved the commission of "non-labor" type torts or crimes, such as assault and battery.

Strangely enough, the Norris-LaGuardia Act did not purport to legalize any labor activities. It merely prohibited courts from issuing injunctions

These Jeffrey welded steel slatted pulleys keep gritty or sticky material from damaging belts. Wide crossbars give good belt traction . . . rounded edges prevent gouging. Cone under-structure assures constant self-cleaning.



## Welded steel slatted pulleys give conveyor belts "9 lives"

Conveyor (and bucket elevator) belts die fast when abrasive or sticky materials lodge between them and the pulleys. Jeffrey welded steel slatted pulleys eliminate these trouble-makers, greatly extending belt life.

These pulleys will not build up substances that cause belt fabric damage and misalignment as when solid face pulleys are used. Their cone design discharges run-offs from the belt before damage is done. Not only are *belts saved*, but the slatted pulley outlasts the solid face pulley as well!

Because of this self-cleaning action, Jeffrey welded steel slatted pulleys are real money-savers in such industries as stone, sand and gravel, clay, chemical, foundry, iron, slag, metal and coal mining, and wood.

### Wide range of sizes

They are available in standard sizes of 12" to 42" diameter and 8" to 42" face width (other size combinations on request). Write today for a quotation on your needs.

Merchandise Sales Division



# THE JEFFREY

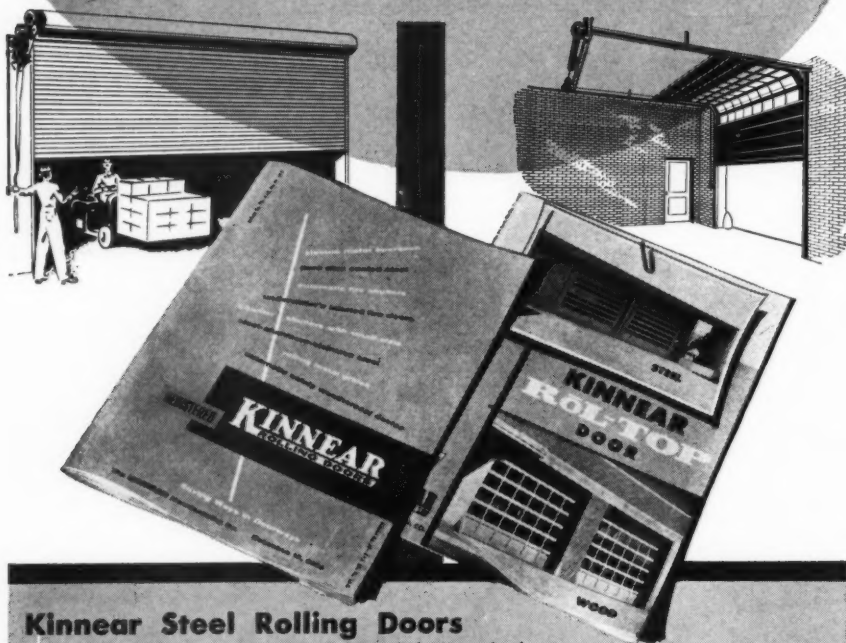
**IF IT'S MINED, PROCESSED OR MOVED  
...IT'S A JOB FOR JEFFREY!**

ESTABLISHED 1877  
**MANUFACTURING CO.**  
Columbus 16, Ohio  
sales offices and distributors  
in principal cities

PLANTS IN CANADA, SOUTH AFRICA



For cost-cutting answers to  
any door need, see these  
**TWO NEW CATALOGS!**



**Kinnear Steel Rolling Doors**

With the coiling upward action of the interlocking steel-slat curtain, originated by Kinnear

**Kinnear Rolling Fire Doors**

All-steel "Akbar" Doors, famous for safety features and labeled by Underwriters Laboratories, Inc.

**Kinnear Steel Rolling Grilles**

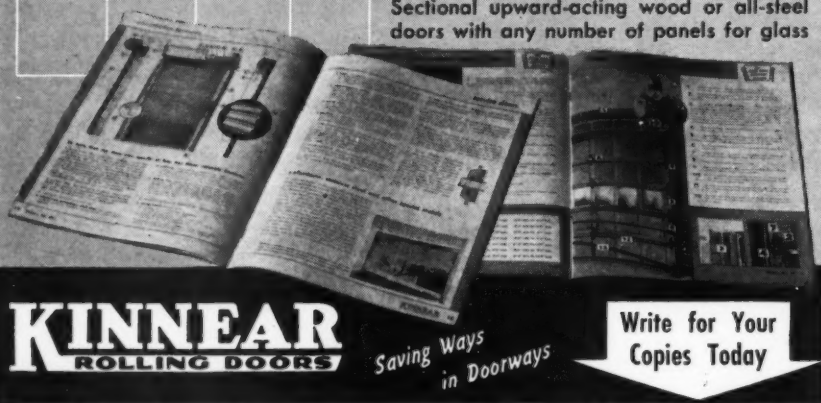
A protective, attractive openwork of steel bars and links—admits light, air and vision

**Kinnear Motor Operators**

Special rugged motors for time-saving push-button door operation

**Kinnear Rol-TOP Doors**

Sectional upward-acting wood or all-steel doors with any number of panels for glass



-----  
**FACTORIES IN COLUMBUS, OHIO and SAN FRANCISCO, CALIFORNIA**  
-----

**The Kinnear Manufacturing Co.**

1560-90 Fields Avenue, Columbus 16, Ohio

Please send new Kinnear door catalogs to:

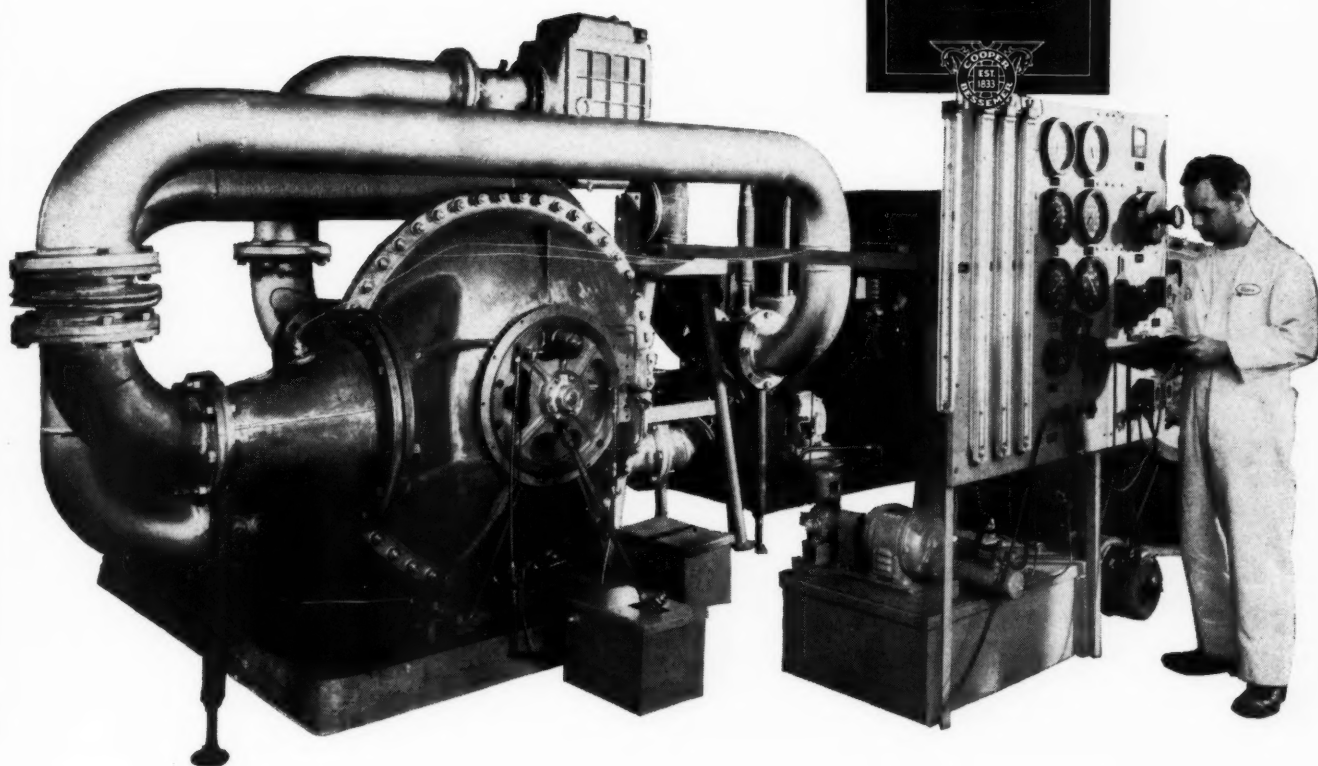
Name..... Title.....  
Firm.....  
Street.....  
City..... Zone..... State.....

against unions in cases involving labor disputes.

There are, in general, only two legal ways to enforce legal rights—by actions at law for damages, or by actions in equity to enjoin the infringement of such rights. With labor unions, damage suits were useless, since the unions were not financially responsible. And, when the right to enjoin their activities was barred by the Norris-LaGuardia Act, there remained no legal way of protecting legal rights against the unions. This forced the employers to fall back on non-legal means, which are known at law as "self-help." Self-help is, of course, the only way of settling disputes among uncivilized beings, but among societies, even of a very low order, it is replaced partly or entirely by legal methods. In "civilized societies," the principal residue of the concept of self-help will be found in those circumstances in which society loses its grip—in those circumstances in which "law and order" is pushed aside in favor of the "law of the jungle"—in other words, in wars.

The reason for the adoption of such "strong medicine" as the Norris-LaGuardia Act was simply because of the great abuse of the injunction in labor disputes. Because the judges were generally sympathetic to the viewpoint of business and unsympathetic toward that of the unions, it was very easy to obtain temporary and frequently permanent injunctions against any of labor's weapons such as strikes or picketing. This, of course, automatically won the battle for the employer. The most insidious feature of the injunction method of settling labor disputes was the issuance by judges of *ex-parte* temporary injunctions at the inception of the disputes. These temporary injunctions, which are by no means limited to labor disputes, are granted by a judge upon request of a person who has filed a claim in an equity court, without the other

CONSULTING ENGINEER



## Hot compressor...prescribed for new problems

**P**RAISE be, American industry is always on the go—always working out new and better ways to do things. A good example is today's incredible chemical and petrochemical industry. As in most other industries, new processing techniques have posed new problems. One is how best to handle the huge-volume compressing of gases and air. And that is a field in which Cooper-Bessemer has a 100-year stake.

Shown above during test stages is one of Cooper-Bessemer's latest answers—a highly efficient, remarkably compact, multi-stage *centrifugal* compressor, that can be driven by electric motor, internal combustion engine or turbine. These space-saving compressors will help solve many new problems of industry; are already in phases of government service.

Although such centrifugal compressors are new in application, they are not new in Cooper-Bessemer experience. Here work on rotating compressor equip-

ment has been under way for years . . . anticipating these very problems . . . and the answers.

It's easy to determine whether your compressor needs can be met best, most economically with reciprocating units . . . or with new-type centrifugals. It's also easy to find out all about the *new* things being done by one of America's *oldest* engine and compressor builders . . . and it pays!



New York • Chicago • Washington • San Francisco • Los Angeles •  
San Diego • Houston • Dallas • Odessa • Pampa • Greggton •  
Seattle • Tulsa • St. Louis • Gloucester • New Orleans • Shreveport  
Cooper-Bessemer of Canada Ltd., Halifax, N. S., Edmonton, Alberta

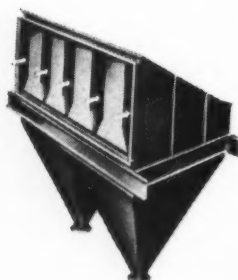
DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS • HIGH PRESSURE LIQUID PUMPS



Your plant and equipment suffers . . . your community goodwill fades away. These problems can be solved. Prat-Daniel Collectors are designed for the control of industrial dusts and flyash. Multiple small diameter tubes provide powerful centrifugal forces, resulting in sustained high collection efficiency . . . even with ultra-fine dusts.

Whether the problem is industrial dust or flyash, you are assured of satisfaction with P-D Collector Systems, engineered to meet your specific needs.

Write for Reprint No. 102 titled, "What Type Collector?"



Project Engineers  
**THE THERMIX CORPORATION**  
GREENWICH, CONN.

(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Que.; Toronto 5, Ont.

Designers and Manufacturers

**PRAT-DANIEL CORPORATION**  
SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

party being given an opportunity to be heard, and normally not even in his presence, on the claim by the applicant that it is necessary to issue a temporary injunction in order to prevent irreparable injury while the suit is pending. Since a suit might be pending for several years, temporary injunctions of this sort were the perfect antidote for strikes.

It is next to impossible to justify the habitual issuance of these *ex-parte* injunctions in labor disputes. Their result was a counter to the self-help weapons of unions through the injunction power of the judges. The employer was virtually let out of it, and in fact, so was the union, which could not possibly win out against the employer. Since the judges were unable or unwilling to restrain themselves, the legislatures gave labor assistance in this respect by removing this power from the judges altogether, insofar as labor disputes were concerned.

The Norris-LaGuardia Act was therefore extremely powerful medicine for an ailing situation. In fact, in retrospect, we can now see that it was much more powerful than called for. What was really required was the removal of the power of judges to grant *temporary* injunctions, or possibly only *ex parte* temporary injunctions. But, instead, the entire power to grant temporary or permanent injunctions was removed, insofar as *bona fide* labor disputes were concerned.

Of course, business is also conducted primarily in the area of economic self-help, but there is always recourse to the law via suits for damages or via injunctions when necessary. But in labor relations, virtually all legal checks on the economic battle were removed. And so the war was on, and it is really not too surprising, though of course very regrettable, that some employers and some unions confused the idea of economic warfare in labor disputes with that of physical self-

CONSULTING ENGINEER



## Features that make an ideal SCHOOL window

# Bayley

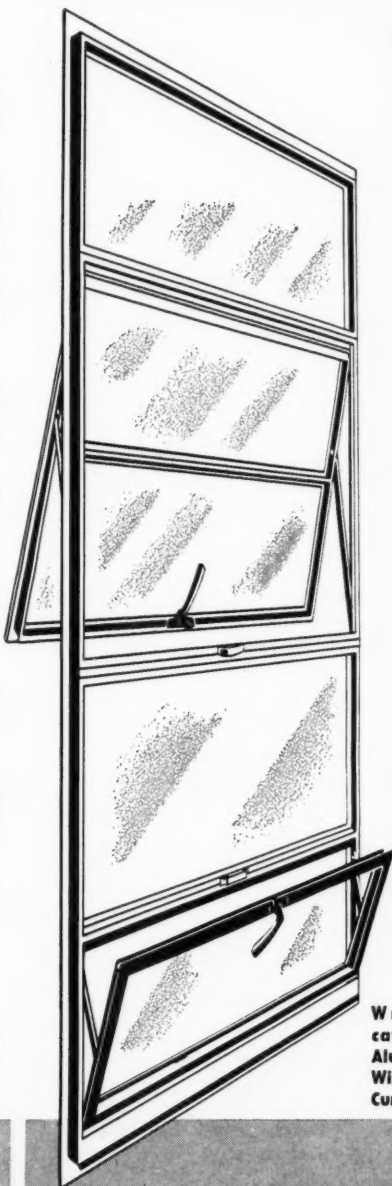
## aluminum projected windows\*

(Same type also available in steel)

### UTILITY

- Offers the ideal combinations of natural daylight, ventilation and visibility for any need.
- Well suited to any type of architecture or construction. Also forms the basic element in Bayley Curtain Wall Systems.
- Easily installed in prepared openings, and readily adaptable to all curtain wall construction systems.
- Permits use of draperies, shades, curtains, venetian blinds, or various combinations of window accessories, with minimum interference.
- Positive, direct-action hardware of quickly apparent operation... No gears, cranks, or complex mechanism.
- Refreshing all-weather air circulation provided by awning-type ventilators that shield opening against rain.
- Draftless, indirect air circulation is provided through fully adjustable projected-in ventilators.
- Exterior of entire window easily washed from indoors. Ends the hazard of having to wash windows from outside.
- Screening easily accomplished. Projected-out ventilators screened inside; projected-in units screened outside.

See Bayley in Sweet's. Complete catalogs on aluminum windows, 16a/Bay; steel windows, 16b/Ba.



### CONSTRUCTION

- Extra deep sections — ample even for Thermopane or Twindow glazing up to 1/2-inch thick.
- Thicker, sturdier, aluminum sections, made especially for windows give extra strength, rigidity, durability.
- Full 1 5/8" ventilator sections, with double contact surfaces parallel to face of window, assure weathertight closure, minimum air leakage.
- Frame and ventilator corners are accurately coped, tenoned, and riveted, for lasting ruggedness and accuracy of fit.
- Ventilators operate on sturdy balance arms connected to sliding friction pivots having non-abrasive shoes with compression springs sealed against dirt.
- Rugged streamlined hardware with easy-grip white bronze handles. Hardware securely attached with stainless steel screws.
- Full 5/8-inch wall engagement provides greater security and rigidity in any type of construction.
- Provision for bed and face putty outside leaves flat, easy-to-clean surfaces inside — the mark of a truly quality window.
- Ventilators glide smoothly and easily, hold at any position, and are not affected by moisture, warping, or sticking.

Write TODAY for catalogs on Bayley Aluminum and Steel Windows and Bayley Curtain Wall Systems.



### \*BAYLEY CURTAIN-WALL SYSTEM

The Bayley Intermediate Projected Window is the basic element in the Series 150 Bayley Curtain Wall System. It is also built into separate prefabricated panels composed of deep-sectioned framing members in the 450 series.

## THE WILLIAM BAYLEY COMPANY

Springfield, Ohio

District Sales Offices:

Springfield

Chicago

New York

Washington

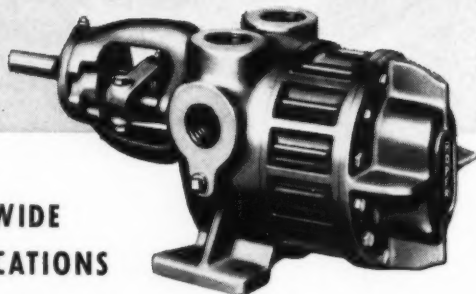
Agents in All Principal Cities

**76 Years of RELIABILITY**

# *Install* **ROPER** **ROTARY PUMPS**

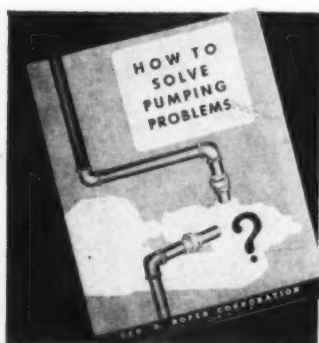
*for Positive Results*

**MODELS FOR AN  
EXCEPTIONALLY WIDE  
RANGE OF APPLICATIONS**



**SERIES F  
PUMP**

SERIES	TYPICAL USES	PRESSURES	SIZES
<b>3600</b>	All Petroleum Handling Grease Compounding Oil Circulating General Transfer	to 60 P.S.I.	40-300 G.P.M.
<b>F</b>	Pressure Lubrication Hydraulic Power Fuel Transfer Lube Oil Transfer	to 300 P.S.I.	1-300 G.P.M.
<b>K</b>	Pressure Lubrication Hydraulic Service Industrial Oil Burner Fuel Supply	to 150 P.S.I.	¼-50 G.P.M.
<b>H</b>	Hydraulic Power Test Equipment Pressure Lubrication High Pressure Coolant	to 1000 P.S.I.	5-75 G.P.M.



**NEW!** LATEST EDITION OF THIS  
BOOKLET NOW READY FOR  
YOU! SEND FOR YOUR FREE COPY

A valuable guide covering important fundamentals of estimating requirements of the average pumping job. It includes tables, charts, sample problems, and other pertinent data. SEND COUPON BELOW.

**Geo. D. Roper Corporation, 649 Blackhawk Park Ave., Rockford, Ill.**

Please Send Booklet—"How to Solve Pumping Problems"

NAME.....

ADDRESS.....

CITY.....STATE.....

**ROPER**  
*Rotary Pumps*

help—in other words with the “law of the jungle” in earnest.

Thus, the Norris-LaGuardia Act was undoubtedly intended as a step in the right direction, but the step was taken with eyes firmly closed—and right over the cliff.

## The National Labor Relations Act

The National Labor Relations Act, or Wagner Act, in 1935, attempted to settle questions of legal rights, as well as to provide ground rules for the conduct of the labor wars.

The purpose of the N.L.R.A. was to end “industrial strife or unrest” caused by “the denial of employers of the rights of employees to organize.” It ended the strife pretty neatly by virtually ordering employers not to resist the unions! The Federal government undertook to help the employees become organized by establishing the National Labor Relations Board and ordering employers not to interfere with labor activities. All the weapons of the employer were removed, except that he was not required by law to sign a collective bargaining agreement but only to bargain with the union in good faith. He could not discuss labor organization pro or con with his employees or discriminate against unionized employees. These and other acts were declared to be “unfair labor practices” of the employer, and were subject to a cease-and-desist order by the board, followed by an injunction, if necessary, by a court of law.

Theoretically, the N.L.R.A. was applicable only to employees “engaged in interstate commerce,” but this too was given an extremely broad interpretation.

By 1935 the pendulum of labor law had run its full course, from the era when organizing a labor union was a criminal conspiracy, through the time when the injunction was used to break strikes, and up to the time when injunctions could not be obtained against unions but were available against management.

CONSULTING ENGINEER



**NOW!**

# A 2-CYCLE DISTRIBUTION BREAKER!

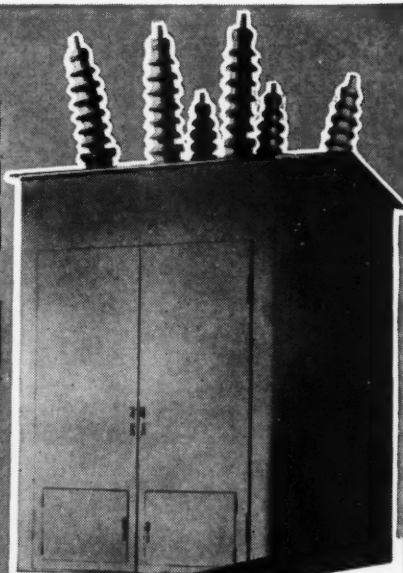
the new  
**Ultra-High-Speed**



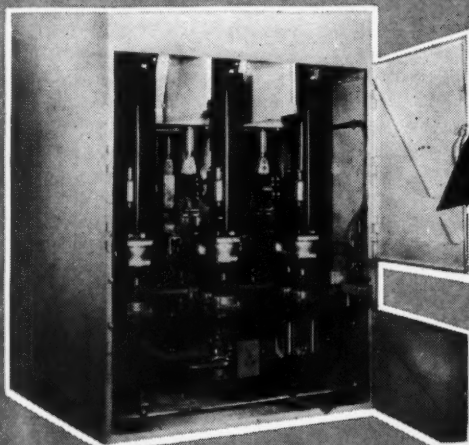
**AIR BLAST  
BREAKERS**

for

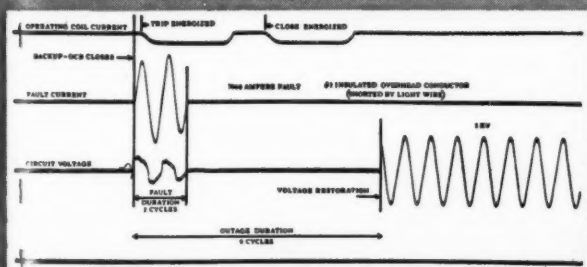
**5, 7.5 and 15 kV  
Distribution Systems**



Overall view of breaker housing. Floor space requirements are comparable to conventional breakers, terminal locations are equally convenient. 3 or 6 standard bushing type current transformers can be accommodated on underside of roof bushings. Relay panels can be placed inside the housing, accessible through separate doors without entering cubicle.



Interior view of the breaker in the housing. Note that both control mechanism and interrupters are easily accessible.



Oscillographic record of close-open operation against 7,000 amps at 5,000 volts with 7.2 kV 800 amps 150 mva Brown Boveri high speed Air Blast Breaker. The same unit was subjected to 27 consecutive close-open operations up to 10,000 amps after which, according to the testing utility, "only a small amount of burning was noticeable, and this only on surfaces that do not carry current."

**H**ERE, at last is a super-fast breaker permitting more economical distribution system design.

The new, complete line of Brown Boveri ultra-high-speed air blast breakers in outdoor housings for 4.16, 7.2 and 13.8 or 14.4 kV (and higher if required) will handle currents up to 1,200 amps with interrupting ratings of 150, 250 and 500 mva at any of these voltages. These breakers have a *guaranteed speed of interruption* from the moment of energizing trip coils to fault interruption of **NOT OVER 2 CYCLES** over the full range of current from zero to full interrupting rating, and regardless of the character and power factor of the load. These Brown Boveri Air Blast Breakers enjoy an exceptional service record because they require a minimum of maintenance and all essential components are easily accessible.

If you have been baffled by the lack of high speed breakers in your distribution system, it will pay you to investigate these 2-cycle Brown Boveri Air Blast Breakers.

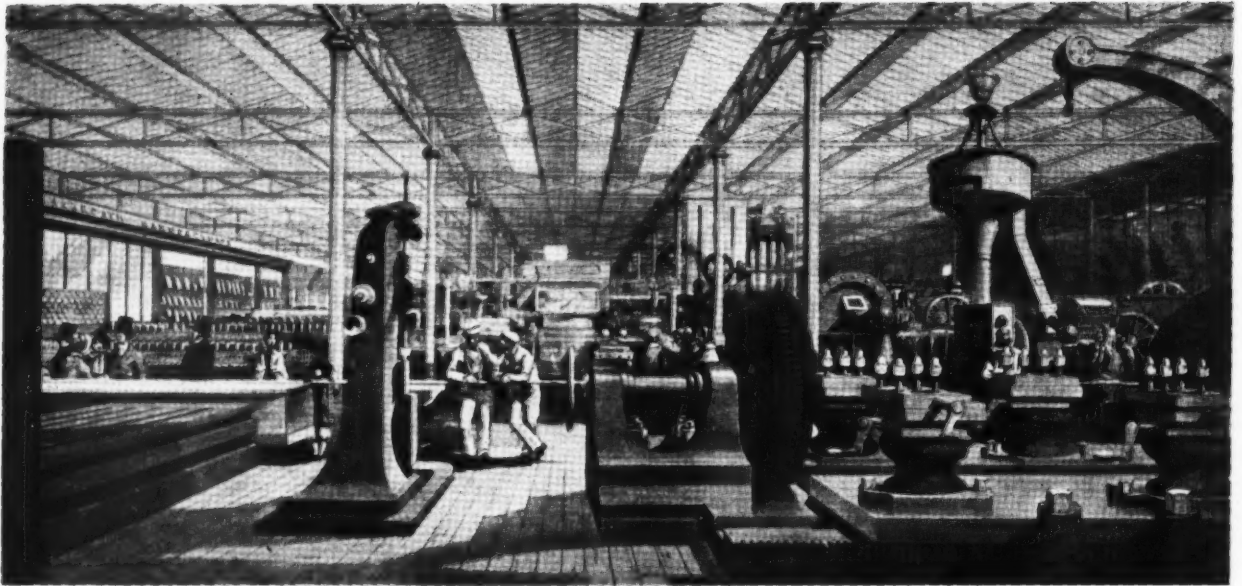
Write for Data, today!

**BROWN BOVERI CORPORATION**  
19 RECTOR STREET, NEW YORK 6, N. Y.

**BROWN  
BOVERI**

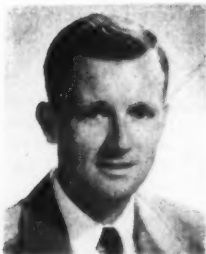
Atlanta, Ga. • Birmingham, Ala. • Boston, Mass. • Butte, Mont. • Chicago, Ill. • Cleveland, O. • Denver, Colo.  
Detroit, Mich. • High Point, N.C. • Jacksonville, Fla. • Kansas City, Mo. • Knoxville, Tenn. • Lewiston, Me. • Los Angeles, Cal.  
Minneapolis, Minn. • New Orleans, La. • New York, N.Y. • Portland, Ore. • San Francisco, Cal. • Seattle, Wash. • Tucson, Ariz.





DOCTORS AND LAWYERS WERE WELL ESTABLISHED IN THE EARLIEST CIVILIZATIONS, BUT ENGINEERS WERE NOT DISTINGUISHED FROM EITHER SCIENTISTS OR CRAFTSMEN UNTIL THE MIDDLE OF THE LAST CENTURY.

## Engineers and Professional Recognition



C. W. GRIFFIN, JR.

Following three years in the Naval Air Corps, C. W. Griffin received his B. C. E. degree from George Washington University in 1949. His professional experience has been primarily in structural design and field inspection with various firms, including Dorfman & Bloom, Consulting Engineers of Philadelphia. Recently, he became an employee of Stewart C. Barnett, Consulting Engineer, of Camden, N.J. He is a registered professional engineer in Pennsylvania.

ENGINEERING never has attained full public recognition as a profession — a state of affairs long recognized and lamented by engineers, and repeatedly substantiated by public opinion polls conducted by leading research organizations and universities. In fact, a recent University of Minnesota survey, which rated various occupational groups in the order of their social standing with the public, reveals the continued low estate of engineers. These results show the practice of medicine enjoying the highest prestige of any profession or vocation, having displaced banking within the past generation. Lawyers rank high — on a par with architects and dentists, although somewhat behind college professors, scientists, and bankers. The most crushing blow to the

engineer's already wounded dignity is the disclosure that despite increased effort his position has not improved materially, while the insurance agent has made the greatest gain in occupational prestige.

What makes the situation doubly difficult is that engineers, in common with the members of most vocational groups, view themselves in a very sentimental light. Speakers at engineering banquets never fail to assure their audiences that engineers are the greatest benefactors of the human race. The failure of engineers to attain equal professional standing with doctors and lawyers usually is attributed to the need for a powerful engineers' organization capable of carrying out an effective public relations program so the public will recognize "the good, the true, and the beautiful."

Admittedly, the role of the professional engineer is little understood by laymen. In contrast to the clearly defined functions of the physician and the attorney, the engineer may be visualized as a mechanic in overalls or a surveyor in puttees. More effective education of the public about the engineer's place in modern technological civilization would help to correct these mistaken ideas. However, the fallacy of placing hopes upon simple solutions to this problem can be demonstrated by analyzing three major factors that appear to contrast most effectively the differences between medicine and law, on the one hand, and engineering on the other. These are: the inertial

**Cp** exclusive

effect of tradition; the character of work and conditions of employment; and the impact of professional individuals and groups upon society.

### Inertial Effect of Tradition

Tradition in human affairs is comparable to inertia in mechanics. Human societies, like physical bodies, tend to remain in their existing state unless acted upon by some force. This inertial effect of tradition acts for good and for ill. On the positive side it conserves the accumulated wisdom of mankind and restrains iconoclasts and revolutionists. On the negative side it conserves superstition and outmoded habits of mind which impede scientific and social progress.

Under the inertial effect of tradition, medicine and law have occupied highly respected stations since the earliest civilizations. Conversely, engineering has suffered. The ancient Greek prejudice against the manual arts and the sciences, especially evident in Plato, was transmitted through Western civilization for two thousand years. Until the pioneers of science won the educational battles in Nineteenth-Century England, cultured men remained proud of their ignorance of science and technology.

The engineer is a relatively recent outgrowth of the medieval master-builder—an itinerant supercraftsman skilled in the ancient arts of design and construction. As J. K. Finch points out in *Engineering and Western Civilization*, engineers were not accorded professional standing until 1672 in France, during the reign of Louis XIV. These first professional engineers were military men, and it was not until 1716 that the first civil engineering group, the Corps de ponts et chausees, was formed.

Scientific pursuits, however, did not gain a recognized place in Western culture until the Industrial Revolution which began in Nineteenth-Century England. Then engineering in the modern sense emerged, and within the past 150 years expanding industry has transformed the Western nations from agricultural communities, little advanced beyond the ancient classical civilizations, into the technologically-dominated countries of today. The engineer has finally overcome tradition and gained a place in modern society, but largely because of his recent origin, his role still is not widely appreciated.

### Character of Work and Conditions of Employment

The second factor contributing to the disparity in public esteem proffered engineers, doctors, and lawyers is the difference in their types of services and their employment conditions. Both medicine and law are highly specialized, basic, human services involving a high degree of client dependence upon the practitioner. Thus, they are of an ideal professional nature because the layman has tangible evidence of the type of service rendered.

In contrast, the technical activities of the modern engineer are difficult for the layman to understand.

Many people, even some construction workers, lack the slightest conception of the division of responsibility between the architect and the engineers on a building project. The lack of an intimate personal relationship between client and agent detracts from public appreciation of engineering as a profession.

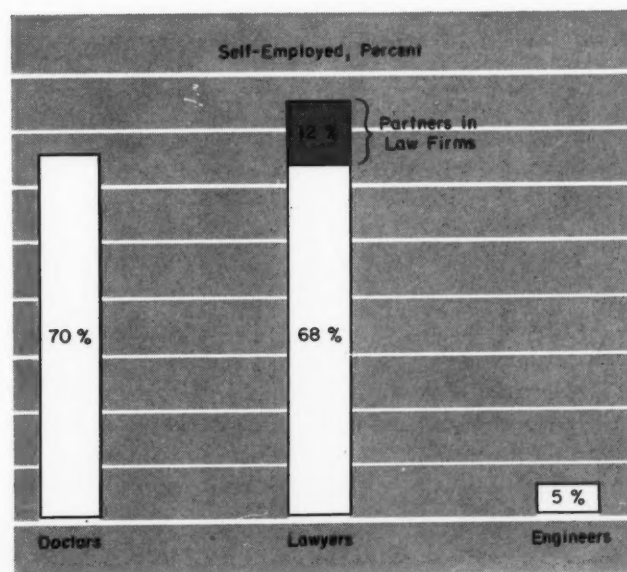
Conditions of employment also are unfavorable to engineers. According to statistics of the American Medical Association and the American Bar Association, over 70 percent of American physicians are self-employed while 68 percent of the lawyers are self-employed and an additional 12 percent are partners in law firms. These self-employed doctors and lawyers, who comprise the numerical majorities of their respective professions, are vitally concerned with the professional aspects of their work.

On the other hand, less than 5 percent of the nation's engineers enjoy self-employed status. This small minority—the consulting engineers—represents the entire profession in matters of professional conduct because most engineers in employee status are understandably, although perhaps not blamelessly, unconcerned with professional ethics. The policy of treating employed engineers as simply another link in a chain of personnel, especially prevalent in some large companies, fails to cultivate in them a sense of creative personal accomplishment and depreciates a professional attitude. This has been recognized as a stimulus to the organization of engineers into collective bargaining units.

### The Impact of Engineers Upon Society

The effects of tradition and, to a lesser extent, the engineer's work and employment conditions are largely beyond conscious control by engineers. However, the third factor—the impact of engineers upon society—is controllable, and controversial.

The popular stereotype of engineers, as revealed by campus jokes and the reciprocated disdain of lib-





eral arts students, pictures the engineer as a narrow-minded, uncultured fanatic addicted to gadgets, mathematics, and scientific observation.

It cannot be denied that many engineers are proud of or at best oblivious to their ignorance of the humanities — perfectly content to be human slide rules and nothing more. For an engineer to have extracurricular talents is considered a minor miracle as evidenced by a New York Times book review describing an author as: "... the rarest of personalities, an engineer with the writer's gift."

Of course, like national and racial stereotypes, this popular picture of engineers is a caricature. Increasing concern by educators and such organizations as the Engineers' Council for Professional Development has widened the cultural horizon of present-day engineers over that of their predecessors. But the ghost of the introverted, socially-oblivious gadgeteer lingers in popular imagery.

Doctors do not suffer from a stereotype. The doctor's high professional standing springs from a long tradition of humanitarian service achieved through the indomitable courage, perseverance, and intellectual qualities of such pioneers as Hippocrates, Galen, Vesalius, Harvey, and Pasteur. The history of medicine is not only a story of man's conquest of pain and disease, but also a story of man's liberation from superstition.

#### Autonomy of Professional Philosophy

As stated in Principles of Medical Ethics: "The profession of medicine, having for its end the common good of mankind, knows nothing of national enmities, of political strife, or sectarian dissensions. Disease and pain the sole conditions of its ministry . . ." Laymen can grasp this philosophy. Similarly, in presenting the ideal of justice as their professional motivation, lawyers remain independent and respected. With both medicine and law, this autonomy of philosophy sharpens their impact on society.

Engineers also have a philosophy — the improvement of the physical conditions of life in all its aspects. But in presenting this philosophy they are content to be faint echoes of the business community. A close professional association between businessmen and engineers is both necessary and unavoidable, but this association need not be a planet-satellite relationship.

Consider what happens when a client negotiates for engineering services and stipulates an unreasonable deadline. Does the typical consulting engineer stand up for his rights as a professional man by insisting upon adequate time to do a thorough, professional job? Far too often he will drive himself and his employees into attempting the impossible. It would be difficult to imagine many doctors or lawyers either being subjected to or submitting to the unreasonable dictates of clients.

The practice of treating engineers as tradesmen

or businessmen rather than as professionals is not confined to the business world. Federal agencies have been known to simply buy engineering drawings and specifications rather than engage full professional services. Several state governments have laws allegedly requiring competitive bidding for engineering services as well as for construction work (but significantly not for legal services in connection with the same work). Some architects "shop" for engineering services.

#### Materialism

However, engineers themselves are at least partially responsible for these conditions. The tendency of many prominent engineers to weave an economic ideology into the fabric of professionalism obscures the tremendous differences between professional ideals and those of the business world. This can create embarrassing ethical problems for engineers.

While the great majority of consultants consider competitive bidding incompatible with professionalism, many of them are unable to present a rational argument against this practice. Frequently their only defense is to invoke the authority of professional codes and to denounce with righteous indignation those who challenged this authority. Still others see nothing wrong in competitive bidding, justifying it with such statements as: "Free enterprise should follow through all phases of American Life."

The much-vaunted "rugged individualism" supposedly characteristic of engineers often has melted when they have faced the threat of losing a valued client. Those who would abandon any professional canon when its observance might entail material loss want a code of expedient conduct, not a code of professional ethics. The present campaigns against engineer's unions seems calculated as much to protect employers' pocketbooks as to elevate professional standards. So long as materialism reigns to this extent, the engineer will encounter difficulty in attaining full professional recognition.

Thus, the engineer's plight cannot be attributed entirely to the effects of tradition and the ignorance of laymen. The engineering profession has failed to convince many of its own members that their work is professional. Engineers have not succeeded in defining in principle and living in practice the professional engineer's proper role in human affairs.

To merit full professional recognition, the engineer must direct more of his energies outward to the needs of society. Without descending to partisanship, he must expand his interests into the domain of social purposes and programs. The increasing importance of technology has placed within his power the opportunity of contributing leadership in mankind's perennial quest for a higher civilization. But the engineer's dogged determination to "know-how" must be tempered with "know-why" if he is to attain the lofty station that can be his.



# Permanent Magnets

## ... history and theory

### STAFF REPORT

THE NATURAL MAGNET ( $\text{Fe}_3\text{O}_4$ ) was well known to the early Greeks, being mentioned by both Thales of Miletus and Socrates (according to Plato in *Ion*). This natural magnet observed by the Greeks and later by the Romans was the mineral lodestone or *magnet*, as the Greeks called it, because it was found in Magnesia in Thessaly. Some natural philosophers of this period thought that there must be tiny hooks on the lodestone and tiny rings on iron. Others promulgated the theory that particles were emitted by the lodestone creating a vacuum toward which the iron moved. While these theories seem far fetched today, it is pointed out in the *Encyclopedia Britannica* that "Of all the phenomena of electricity and magnetism, frictional electricity and ferromagnetism are the oldest known to man, and perhaps the least understood today."

The magnet remained nothing more than a curious natural phenomenon until the invention of the compass, first clearly mentioned by Shen Kua (1030-1093), though legendary accounts in China go back as far as perhaps 2700 B. C. Gradually the compass came into common use on both land and sea, but still little study was made of the magnet until 1600, when William Gilbert of Colchester, England, published *De Magnete*. This book put together in one place all of the known material concerning magnetism that Gilbert could gather. It was he who discovered that the earth itself is a magnet, and he also learned that magnetized iron lost its magnetism when heated to a red heat—and gained it again when cooled.

#### The Scientific Approach

A new scientific interest in the magnet arose in the latter half of the 18th century, discoveries paralleling the general scientific progress. Coulomb established the inverse square law of attraction (that the attractive force diminished as the square of the distance from the pole); Oersted found a relationship between electricity and magnetism when he noted that an electrical current affected a magnetic needle. Ampere found that a current flowing in a closed circuit is the equivalent of a "magnetic shell," and this led to his conclusion that the pulling power of a mag-

net was the result of electric currents flowing within the molecules. This theory still stands in modified form as elaborated upon by modern understanding of electron theory and quantum mechanics.

The concept of a relationship between electricity and magnetism led quickly to the invention of electromagnets. The electromagnet seemed to offer so much more than the permanent magnet that most of the scientific thought and experimentation after 1825 went into this aspect of magnetism. Faraday and Henry discovered electromagnetic induction, in which magnetism is turned into electricity as in a transformer, thus making possible the construction of generators and motors. It is only natural that with these important discoveries dealing with electromagnetism, little attention was paid to the development of permanent magnets.<sup>1</sup>

#### Magnetic Theory

However, the whole field of magnetic phenomena continued to be investigated. It was in 1907 that P. Weiss advanced the theory that ferromagnetic materials (iron, nickel, cobalt, and alloys of these and molybdenum, chromium, and copper<sup>2</sup>) are composed of many small regions, or domains, each magnetized to saturation in some direction. These domains are approximately 1/1000 of an inch long and 1/10,000 of an inch wide and deep. Each of these domains contains many thousands of molecules. When the ferromagnetic material is not magnetized, these domains are distributed at random or balance each other so that the magnetism of the whole is zero. But when magnetized, these domains take distinct positions, and in working together, they produce a magnetic field for the specimen, as illustrated in Fig. 1.

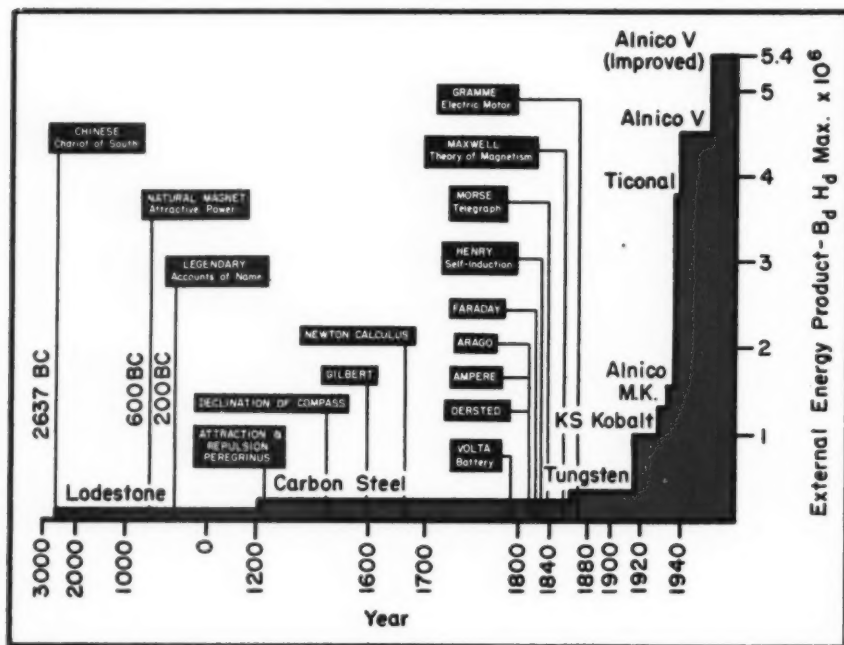
Carrying current theory a step further, the basic

<sup>1</sup>It should be noted that there is a difference between natural magnets and permanent magnets. The natural magnet, lodestone, is permanent, but all permanent magnets are not natural. Permanent magnets are made when ferromagnetic materials of low permeability are magnetized so that they tenaciously hold their magnetism.

<sup>2</sup>Some alloys of iron and cobalt have greater magnetic force than either iron or cobalt alone. This cannot be satisfactorily explained.



## Permanent Magnets



CHARTED HISTORY OF MAGNETS. COLOR SHOWS IMPROVEMENT OF PRODUCT.

magnetic particle is the electron. In ferromagnetic materials, the magnetic forces are derived from the incomplete third electron shell of the atom. In the iron atom (Fig. 2) there are four "shells" formed by the electrons spinning about the nucleus. All of these shells are balanced by an equal number of electrons spinning in one direction against an equal number in the opposite direction — except the incomplete third shell. Here there are nine electrons spinning in the plus direction and five in the negative. It is this unbalance of "electrical" forces that is thought to account for the magnetism of ferromagnetic materials.

Since about 1920, the principal work in the field of permanent magnets has been toward the develop-

ment of better alloys. The Alnico magnets represent the greatest technological advances resulting from the alloying of metals.

### Magnetic Characteristics

The units used in the measurement of magnetic characteristics are unfamiliar to most engineers. Gilberts, gaussses, maxwells, and oersteds are not part of the engineer's everyday working vocabulary. But it is necessary to know something of these units and their application in order to understand the measurement of magnetic characteristics. The magnet derives its strength from lines of flux. This flux over a square centimeter of area (flux density) is measured in gaussses and is called magnetic induction. In the curves used to depict characteristics of permanent magnets, magnetic in-

duction is plotted vertically on the ordinate-Y axis.

The abscissa — X axis — is measured in oersteds, or magnetizing force. By definition, the field strength one centimeter from a unit pole is one oersted. The oersted also is defined as gilberts per centimeter, and since a gilbert is  $0.4\pi$  ampere turns, we can think of the oersted in terms of current.

Therefore, on the graph on which we plot gaussses against oersteds, we are plotting the magnetic induction of the magnet against the magnetizing force involved. Now, if we take a piece of iron or other ferromagnetic material that has never been magnetized and apply to it a magnetizing force (oersteds), a flux will be induced in the specimen measurable in

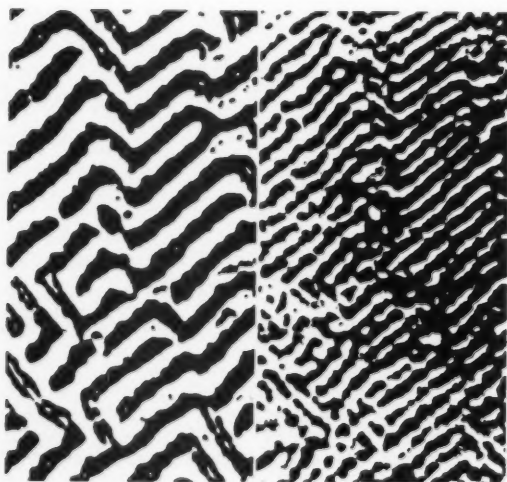


FIG. 1—POWDER ON SURFACES OF IRON CRYSTALS SHOWS MAGNETIZED ((LEFT) AND UNMAGNETIZED DOMAIN STRUCTURE (1250X).

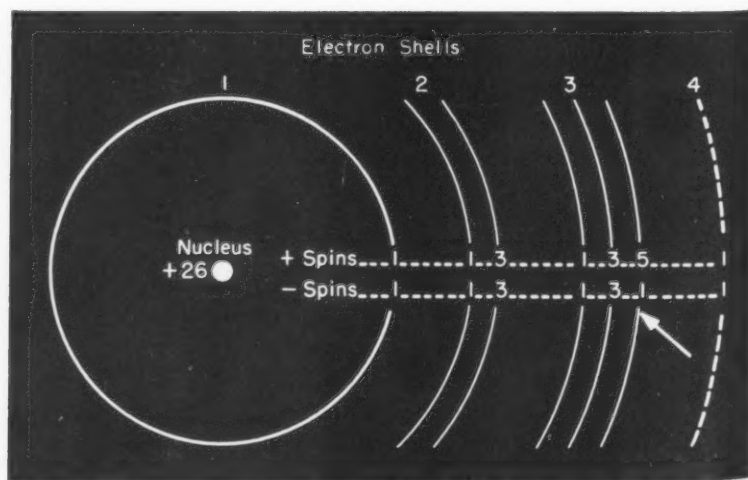


FIG. 2—AN ATOM OF IRON HAS FOUR ELECTRON SHELLS AS INDICATED ABOVE. THE OPPOSITELY SPINNING ELECTRONS BALANCE IN ALL EXCEPT THIRD SHELL, RESPONSIBLE FOR THE MAGNETIC MOMENT.

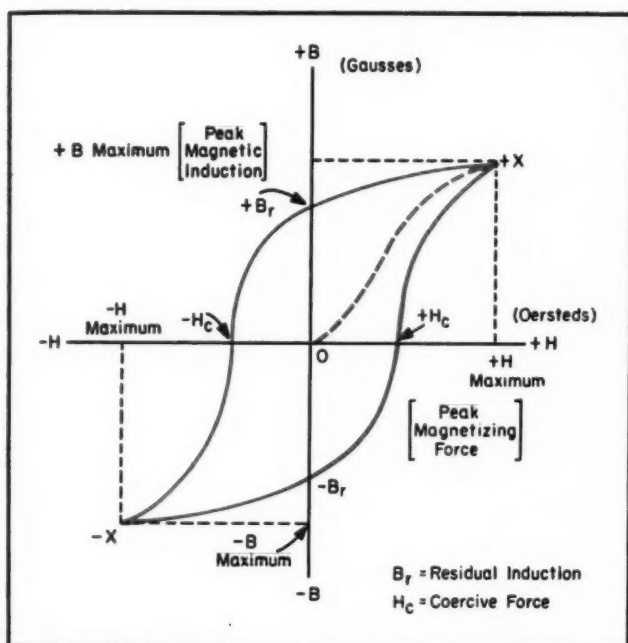


FIG. 3—HYSTERESIS CURVE FOR PERMANENT MAGNET.

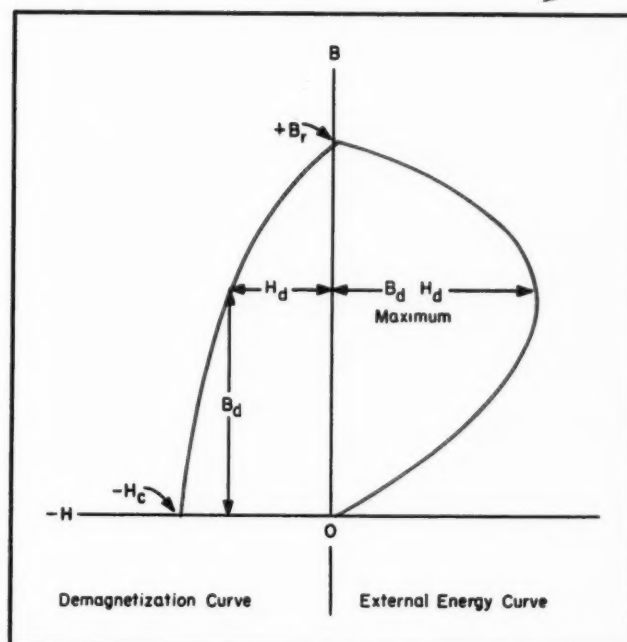


FIG. 4—DEMAGNETIZATION-EXTERNAL ENERGY CURVES.

gausses. This application of a magnetizing force will result in the curve  $O$  to  $+X$  as shown by the dotted line in Fig. 3.

If the current of the magnetizing force is reduced to zero, the magnetic induction will also shrink, following the line  $+X$  to  $+B_r$ . At this point we have a permanent magnet with an induced magnetism of  $+B_r$ , as measured in gauss. If we were to reverse the current in the coil of wire giving the magnetizing force, we would have a negative magnetizing force tending to decrease the magnetic induction of the specimen. This would follow line  $+B_r$  to  $-H_c$  to  $-X$ , at which point the polarity of the specimen would have been reversed. If we start again at  $-X$  and follow the same process of reducing the magnetizing current and then reversing it, the curve would be as shown by  $-X$  to  $-B_r$  to  $+H_c$  to  $+X$ . This would determine the complete hysteresis loop for the permanent magnet material.

#### Demagnetization Curves

In studying the characteristics of permanent magnets, the portion of the curve in the second quadrant ( $+B_r$  to  $-H_c$ ) is of most interest. This is that portion showing the condition of the magnet from the point of no magnetizing force (but a considerable amount of residual magnetism,  $+B_r$ ) to the point where there is no residual magnetism as a result of the application of an electrical current of opposite polarity ( $-H_c$ ). This might be thought of as the portion of the curve in which a permanent magnet, with all of its magnetic induction, is destroyed by the application of an opposite polarity current.

Fig. 4 shows the further use of the curve in this second quadrant. In this curve we show only the por-

tion from  $+B_r$  to  $-H_c$ . To the right of the ordinate another curve is drawn. This curve is the product of  $B$  and  $H$  at any point on the curve from  $+B_r$  to  $-H_c$ . There is one point on the curve at which  $B$  times  $H$  will be a maximum. This is the optimum point at which a permanent magnet will have a maximum energy output. This external energy curve is proportional to the energy, in ergs, that each cubic centimeter of magnet can supply for external use in the air gap between its poles.

#### Permeability

It can be seen on the curve of Fig. 3 that there is a direct relationship between  $B$  (gausses) and  $H$  (oersteds). In fact, in air  $B$  is numerically equal to  $H$ . The coefficient of magnetic permeability,  $\mu$  (ratio of flux density to magnetizing force) is unity. For iron, on the other hand, permeability  $\mu$ , is high, so that  $B = \mu H$ , and one oersted of magnetizing force produces a large flux density in gauss. For example, permeability for carbon steel is about 110; for Alnico 5 about 18; and for Vectolite, a sintered material of iron oxide and cobalt oxide, about 1.11. Soft iron has a permeability of 5000–10,000.

It will be noted that magnetic materials of high permeability such as soft iron are easily magnetized and demagnetized and hence make good cores for electromagnets. Magnetic materials of low permeability are magnetized with more difficulty, but they retain their magnetic characteristics.

In fact, permanent magnet stability is astounding. A properly designed and applied permanent magnet of Alnico 2 (such as is used in a domestic watt-hour meter) will remain consistent within a few one-hundredths of one percent per century.



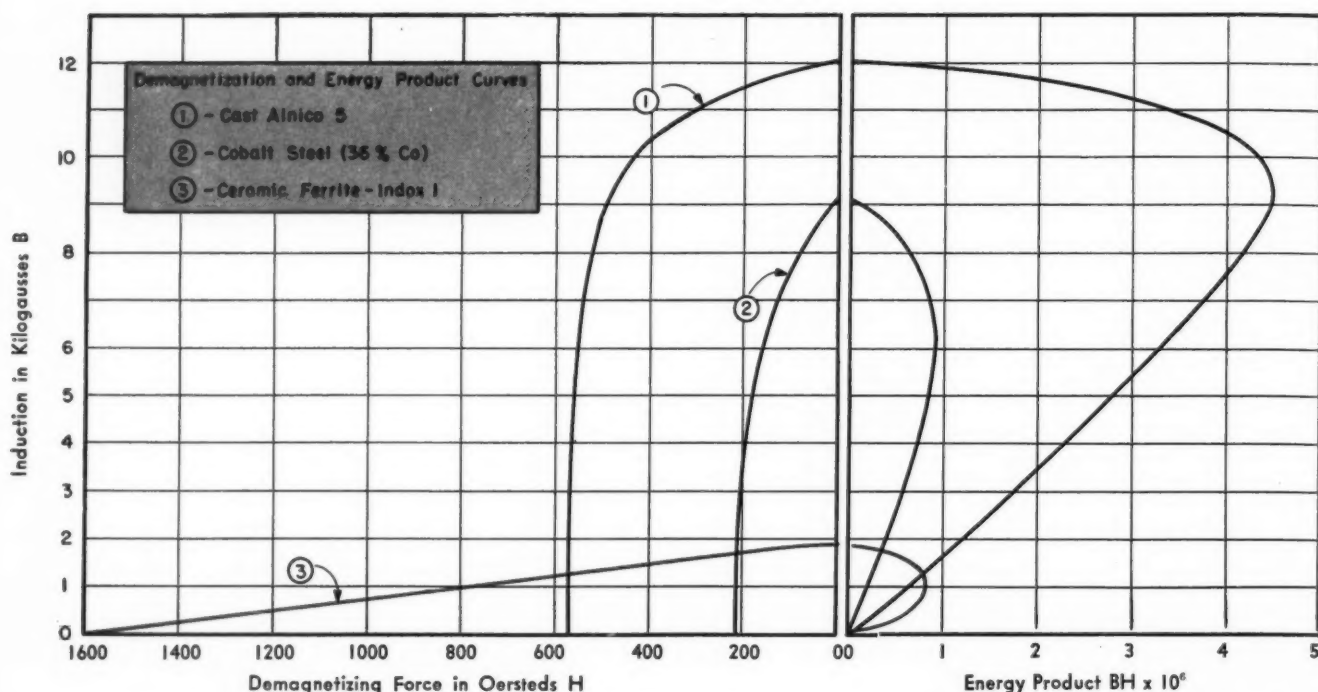


FIG. 5—DEMAGNETIZATION (LEFT) AND ENERGY PRODUCT CURVES FOR THREE PERMANENT MAGNET MATERIALS.

## ... metallic oxides ... old materials in new forms

IT HAS LONG BEEN KNOWN that certain oxides of iron (and other ferromagnetic metals) have magnetic properties. The natural magnet, lodestone, is an oxide of iron and was known to the early Greeks, the Romans, and the Chinese. However, most of the important work on magnetism in the past century was done with metallic iron or an alloy of iron rather than with an iron oxide. Some experimental work with ferrites was done in the twenties, but it was not until the mid-forties that research indicated real possibilities for ferrites as permanent magnets.

### Ferric Oxide Magnets

The Philips Laboratories, in Holland, published an important monograph by J. L. Snoek, in 1947, in which they outlined their research progress in the search for a method to produce a good permanent magnet made of ferric oxide. They called their product Ferroxcube, and in 1954, they published another paper by Stuijts, Rathenau, and Weber, in which they described later developments known as Ferroxdure II and III. Philips secured a patent on the process used in the manufacture of these magnets and have now licensed several companies in this country to manufacture magnetized ferric oxides. The Indi-

ana Steel Products Company is one of the larger manufacturers under this license.

Ferric oxide has four crystalline forms each having different magnetic properties. Corindon is a ferric oxide with a rhombohedral crystalline structure. It is better known by its mineralogic name, hematite. The  $\text{Fe}_2\text{O}_3$  in this structure is called alpha  $\text{Fe}_2\text{O}_3$ .

The second type of ferric oxide is the cubic, or spinel, type having strong magnetic properties generally comparable to magnetite ( $\text{FeO} \cdot \text{Fe}_2\text{O}_3$ ). Its designation is gamma  $\text{Fe}_2\text{O}_3$ .

A third form is a new rhombohedral type closely related to alpha  $\text{Fe}_2\text{O}_3$ . It is strongly ferromagnetic; can be made into strong, stable permanent magnets.

A fourth form is crystallized in a hexagonal system and is ferromagnetic but very unstable, losing its ferromagnetic properties at only 100 C. It is proposed that this be called delta  $\text{Fe}_2\text{O}_3$ .

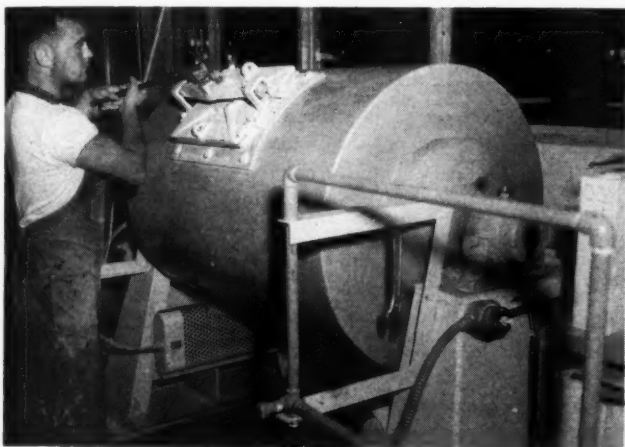
### Recent Research

Both the chemical and physical characteristics of ferric oxides have important influence on their magnetic properties. Chemical constitution and its relation to magnetic properties was described by J. Percy in 1873. He was probably the first to perform the in-

initial steps leading toward the manufacture of the ferrites as they are fabricated today. His procedures and his description of the products were noted only as curiosities, since there was no foreseeable use for these ferrite compounds.

About 1910, S. Hilpert was issued a patent, in Germany, covering the manufacture of ferrite compounds. It was he who set forth the general premise of chemical combination of  $\text{Fe}_2\text{O}_3$  with other metal oxides to produce the sintered type of ceramic magnet. Again both the product and the theoretical explanation were shelved, since metallic cores seemed a more efficient and positive way to obtain the magnetic power needed for practical applications.

A study of the practical applications of the magnetic ferrites was delayed until quite recently, though

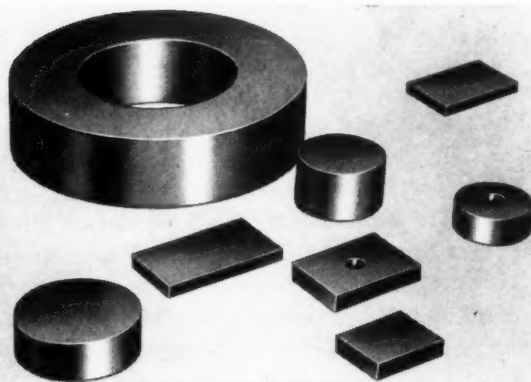


BALL MILL OF TYPE USED IN GRINDING FERRITES.



IN MAKING MAGNETS, FERRITES ARE HEATED IN KILNS.

## Permanent Magnets



Indiana Steel Products

FERRITE MAGNETS ARE MADE IN VARIETY OF SHAPES.

there was some excellent purely theoretical work done in the mid-twenties.

In the thirties, two Japanese experimenters, Kato and Takei, searching for methods to reduce eddy current losses in communications equipment, began intensive work on magnetic ferrites. Their work resulted in the finding of the proper mixtures of several oxides to give the specific properties needed for the new type of magnetic core. This work was continued and resulted in improved methods of fabrication and comprehensive theories on the magnetic properties of the ferrites.

### Manufacture of Ferrites

There are several steps involved in the manufacture of ferrites for practical use as magnetic cores:

The initial step is the selection of the proper materials in the proper proportions to give the physical characteristics in the molded magnet. The simplest mixture is a 1:1 molecular ratio of ferric oxide and calcium oxide. After weighing, these oxides are ground together in a ball mill or other grinding apparatus until all materials will pass through a No. 325 sieve (the finest standard size). After grinding the powder is heated to whiteness in an oxidizing atmosphere, either oxygen or air. When cooled in the furnace to room temperature, the mixture will be in the form of long, needle shaped crystals having a dark, shiny, metallic luster. These crystals are somewhat magnetic even at this stage.

The next step is to take these crystals and grind them to the same fineness as before. A binder of shellac or Bakelite or of some inorganic material such as water glass then is added to aid in forming the powders into the required shape at pressures of about 4 tons per  $\text{cm}^2$  (10 tons/ $\text{in}^2$ ). The billet then is reheated to about 200 to 300 C and cooled in a magnetic field. This ceramic type product is quite hard and does not machine well with tool steels. Changes in dimensions require grinding on a magnetic chuck.

This ceramic technique of mixing generally is accepted as the proper one for the production of ferrites, but a chemical method outlined by H. Fores-



## Permanent Magnets

tier and G. Chaudron in 1925, seems to offer possibilities, and if practical it could eliminate the time consuming first steps of grinding and mechanical mixing. Grinding of crystals still would be required.

Of the ferrites produced under the Philip's patents, the one presently on the market is  $\text{BaFe}_{12}\text{O}_{19}$ . The second ferrite announced seems to contain  $\text{FeO}$  that remains in the ferrous ( $\text{FeO}$ ) state. This is known to be highly desirable so far as magnetic properties of the combination are concerned. These iron oxides are of the inverse spinel crystal type containing gamma  $\text{Fe}_2\text{O}_3$ .

### Ferrite Characteristics

An important advantage of these simple alkaline earth ferrites is their low raw materials cost and the fact that none of the materials involved are critical or scarce. However, there are possibilities for the fabrication of excellent magnets from oxides of other metals such as nickel, chromium, and cobalt. The ceramic type cores would be made from these oxides in much the same manner as that described for the ferric oxide-calcium oxide material.

One indication of the enormous difference between these magnets and the metallic permanent magnets such as Alnico is seen in comparing the permeability of the materials. Carbon steel has a maximum permeability of 110, Alnico 5 a maximum of 18, but some of these ferrites have a permeability of as low as 0.001. This means that the permeability of some of these materials is almost a thousand times less than air. As a result, they require a lot of current to magnetize them in comparison with other permanent magnets, but they retain their magnetism despite mechanical shock, vibration, impact, stray magnetic fields, or changes in the external magnetic circuit such as the increase of the air gap. They are, in other words, remarkably stable magnetically.

### Magnetic Properties

Fig. 5 shows a comparison of several magnetic materials including one manufactured under the Philips patents and sold by The Indiana Steel Products Company under the trade name Indox 1. With this ferrite, note how much greater field strength,  $H$ , is required for the much lower induction,  $B$ .

These ferrite materials have another important characteristic. They can have extremely short length. As shown in Fig. 6, the ferrite can have a short length with a large pole area. Comparing an Alnico magnet with an Indox 1 magnet, the Indox magnet would have about one-half the magnetic length but ten times the cross-sectional pole area.

Practical applications for these ferrite magnets have been expanding rapidly. They are exceptionally useful where it is necessary to reduce Foucault or eddy currents, and in many other respects they make as good or better magnets than the metallic types.



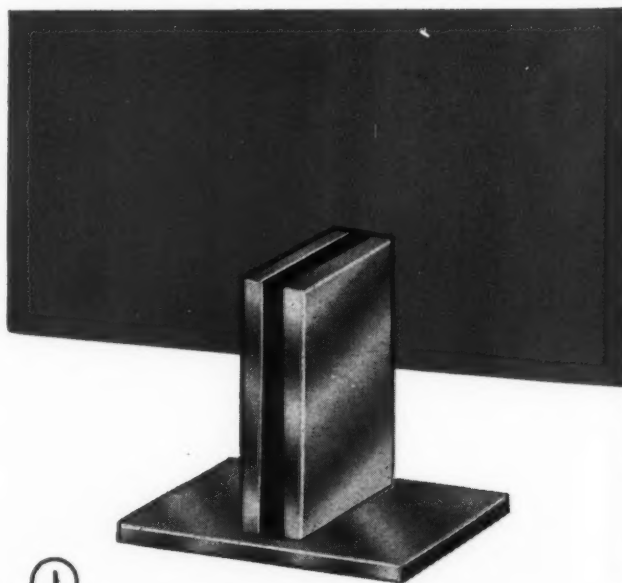
... a basic

CARL SCHULTZ, who conceived the idea of a permanent magnet device in which the force at the poles can be varied, says that he is an American citizen by grace of a fast boat. He was born shortly after his parents arrived in St. Joseph, Michigan, from Europe.

According to his degree from the University of Michigan, Schultz is a lawyer, and he practiced as an attorney until the late thirties. At that time his interests were turned to chemistry when he and two associates, George Krasl and Joseph Sauer, found a way to simplify and speed the analysis of steel to determine carbon and sulphur content. They organized the Laboratory Equipment Corporation and proceeded to manufacture the scientific instruments needed in steel mill laboratories. Their firm grew rapidly and now is the country's largest producer of steel-analysis instruments.

Schultz is also president of Benton Harbor Malleable Industries, with a malleable foundry, grey iron foundry, die casting plant, and machine shop.

He became interested in permanent magnets a number of years ago when Laboratory Equipment Corporation started producing the Leco-Latch (a small permanent magnet latch for cabinet doors) as a sort of side-line product.



① WHEN FERRITE IS PLACED BETWEEN STEEL POLE PIECES, MAGNET UNIT HOLDS WITH FORCE OF 50 LB.

CONSULTING ENGINEER



# c concept... varying the magnetic force

JUST SIX MONTHS AGO, Carl E. Schultz, of St.

Joseph, Michigan, president of Laboratory Equipment Corporation, announced that he had filed for a patent on an application of permanent magnets. His idea involves the varying of a magnetic field in soft steel pole plates used to conduct magnetic flux collected from the poles of a ceramic type, ferrite permanent magnet.

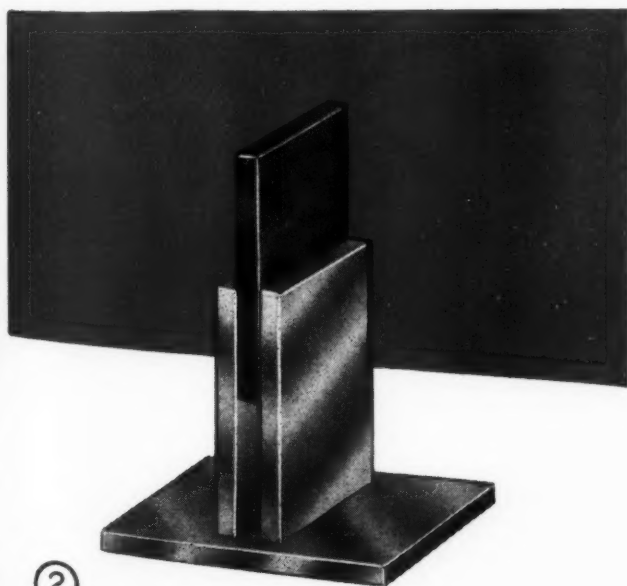
## Why it Works

To understand the implications of the patent, it is necessary to first understand that ferramics (see page 50) can be magnetized so that the poles have a very large area in comparison with the length of the magnet. This cannot be successfully done with metallic magnets, as they usually are at least three times as long as in cross section. The ferrite magnet can be made in a short length as though it were a slice taken across a long, bar magnet. This broad area of the poles is important, for it means that soft steel pole pieces can collect the flux from the large pole area, yet the magnet itself can be quite thin. Therefore, it can fit into smaller spaces and have considerably less weight, the ferrite being of low density.

It is next necessary to understand that ferrite, because of its extremely low permeability is most stable magnetically. Removing the pole pieces and replacing them time after time has little or no effect on the

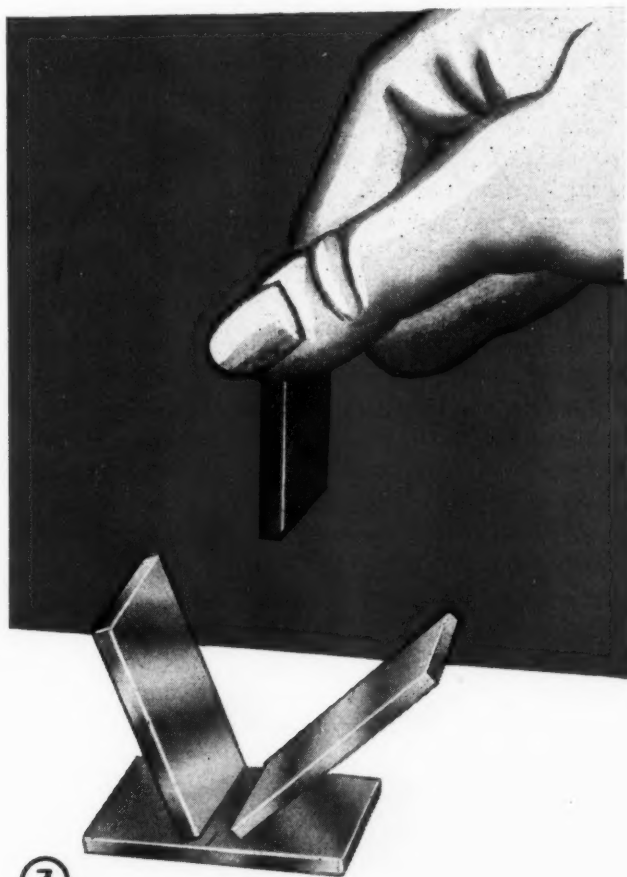
magnetic properties of the ferrite. This is not true of metallic magnets. When they are removed from their pole pieces or even if the keeper across their air gap is removed, they lose considerable flux density.

When a small ferrite magnet is placed against a piece of iron, the magnetic attraction does not seem to be particularly strong. Even the broad area of the poles does not give the magnet unusually strong holding powers. Anyone using a small ferrite magnet to lift a block of iron would conclude that ferrite had little to offer as a permanent magnet material. It is only when soft steel pole pieces have been placed over each pole and the lines of flux conducted to the ends of the pole pieces that the great holding power of the ferrite magnet becomes apparent. For example, if a piece of ferrite  $1\frac{1}{2}$  X  $1\frac{1}{2}$  X  $\frac{3}{16}$  in. is placed against a piece of iron of equal or larger surface area, it will have a holding power of only about 10 oz. But if soft steel pole



②

HOLDING FORCE DROPS AS FERRITE IS WITHDRAWN FROM BETWEEN SOFT STEEL POLE PIECES AS SHOWN.



③

ALL ATTRACTION STOPS WHEN FERRITE IS REMOVED. POLE PIECES NO LONGER HOLD TO STEEL KEEPER.



## Permanent Magnets

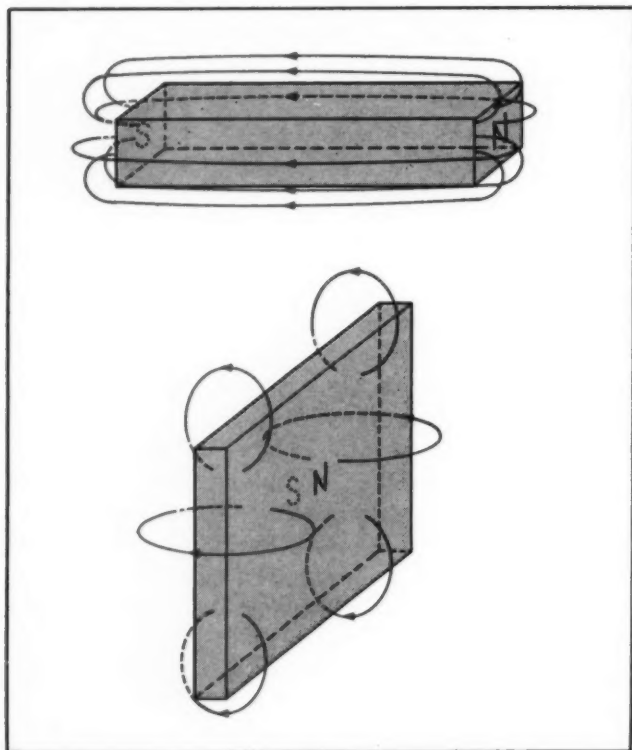


FIG. 6 — COMPARISON OF BAR MAGNET AND FERRITE MAGNET INDICATING LENGTH AND LINES OF FORCE.

pieces are positioned over each pole of the ferrite, the ends of the pole pieces will have a holding power of nearly 50 lb — an amazing increase in strength.

To put this another way, in the first of the three views at the bottom of pages 52 & 53, two steel pole pieces are being held to the ferrite with an attraction of about 10 oz each, but the steel plate on which the magnetic unit is resting is being held to the unit by a force of about 50 pounds.

### Regulating the Force

These characteristics of ferrite magnet materials suggested to Schultz a basic idea that is entirely new to the science of permanent magnets. This concept is illustrated in the drawings. It involves the regulation of the magnetic force across the air gap at the ends of the pole pieces by inserting or withdrawing the ferrite between the pieces. This sounds like the very essence of simplicity — and it is. It seems, however, that no one had thought of there being any practical value in this concept nor had anyone thought of patenting it. When the ferrite is fully between the pole pieces, there is a very strong magnetic field created, with lines of force going from the north pole plate across the air gap to the south pole from all four edges. The drawings show (to  $\frac{3}{4}$  actual size) a magnet with a lifting power of about 50 lb when in direct contact with a piece of iron being lifted. On the other hand, it takes only about a 4 oz pull, including friction, to slide the ferrite out from between the two pole pieces. As the ferrite is pulled out, the force

across the air gap is gradually reduced, until upon complete removal, there is no force at the poles at all. Since the pole pieces are of soft steel with a high permeability, there is very little residual magnetism, so the force drops practically to zero, and anything being held by the magnet falls away.

What we have here is a permanent magnet that can be made to act in some ways as though it were an electromagnet. An electromagnet can be energized and de-energized by the application of an electric current. The poles are magnetic only so long as current is flowing in the coils around them. Similarly, this permanent magnet can be "turned on and off" merely by mechanically positioning the ferrite.

### Research is Needed

While the practical functioning of the unit is simplicity itself, the theoretical balances of work and energy may not be so simple. How can this small magnetic unit develop a total attractive force of 50 lb at the pole pieces when each pole of the ferrite has an attractive force of only 10 oz? Do the magnetic domains in the steel pole pieces line up when influenced by the lines of flux of the ferrite and become additive? Will other designs of magnetic units made up of other shapes of ferrite or other arrangements of pole pieces offer even greater multiples of attractive force? The answer to these questions will have to wait further experiment and theoretical exploration. It seems likely that practical application of this principle will be common before we have theoretical explanations of the principles involved in the actions of permanent magnets.

### Practical Applications

The point here is that the applications are numerous, and some of them are possibly revolutionary. The simpler applications are based upon the fact that here we have something like the equivalent of a magnetic lever. If the revolutionary aspects of the mechanical lever are recognized, this gives some idea of the possible value of the magnetic "lever." If a mechanical lever were constructed with a ratio of 200:1, theoretically it would be possible to raise a 200 pound weight on one end by the application of 1 pound on the other. Recognizing that the work done is balanced equally, one end against the other, it is still vitally important that the lever principle permits a force of 1 pound to control 200 pounds on the short end of the lever.

By using only  $\frac{1}{4}$ -lb force in sliding the ferrite out of the pole faces, 50 pounds of force can be controlled at the air gap. In this sense, Schultz has built a magnetic lever. The application of the principle of the magnetic "lever" offers sufficient incentive for product development for many years ahead.

On the following pages are short descriptions of some basic applications.

# ...latches, hitches, holding devices

ABOUT TEN YEARS AGO, Laboratory Equipment

Corporation started manufacturing a small cabinet latch, called Leco-Latch. It was nothing more than a small Alnico magnet which, when fastened to the shelf of a cabinet, was used as a holding piece. A small, soft steel plate was then fastened to the door of the cabinet. When closed, the door was held shut by the attraction of the steel door plate to the small magnet. Since the holding power of the magnet was small, it was easy to open the cabinet door with a slight pull.

While the Leco-Latch could hardly be called revolutionary, it sold well and went into thousands of kitchens throughout the country. Its greatest advantage over the regular cabinet latch lay in the fact that there was nothing to wear out, no spring tension, no moving parts.

It was in working with this gadget that Carl Schultz and the research men at Leco became interested in permanent magnets. In working with the new magnetic ferrites Schultz hit upon the idea of varying the force between the poles by positioning the ferrite. The surprising aspect is that it had not been done years before.

## Improved Latch

Schultz's immediate thought was that this concept would permit a much improved Leco-Latch. No longer need the latch be a weak magnet that held the door closed with only enough force to allow it to be easily opened with a slight pull. Now, it would be possible to use a strong magnet — one that would hold the door against a pull of 50, 100, or 200 pounds. Yet the latch could be released with a force



TESTING THE HITCH — IN THE EDITORIAL OFFICES OF CONSULTING ENGINEER — A PLAYGROUND SWING IS

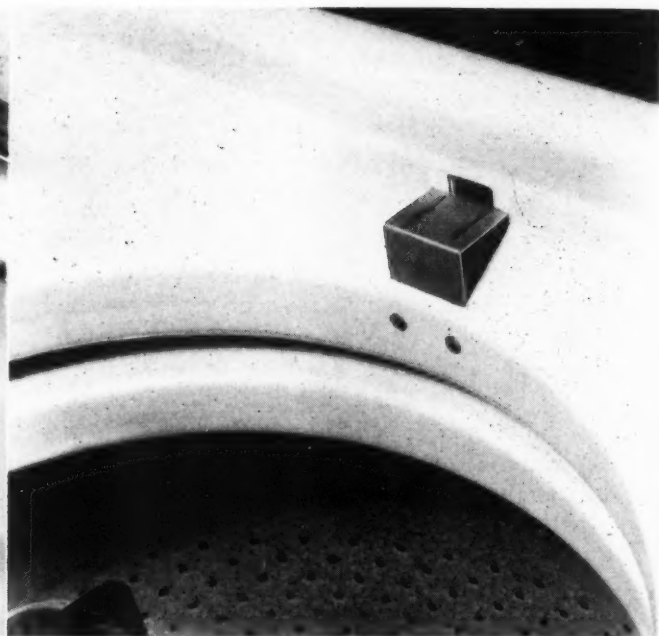
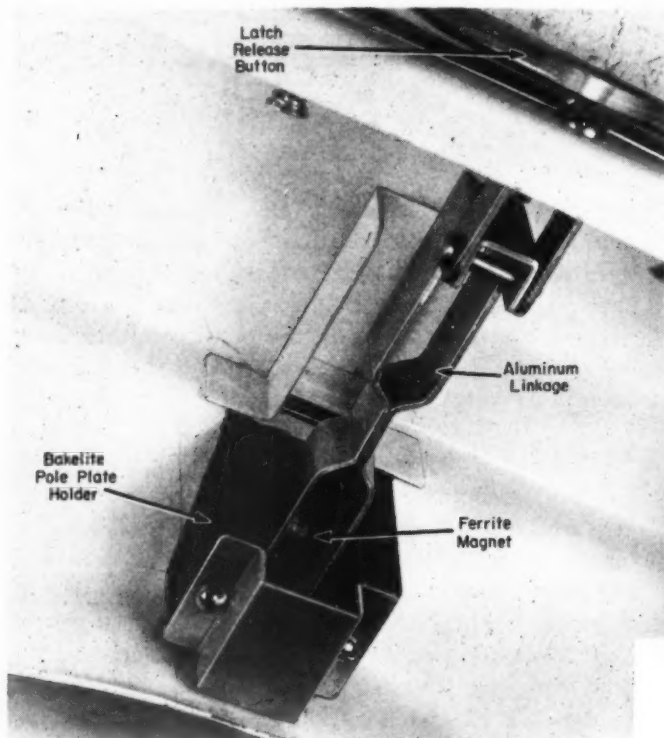


HOOKED TO HOLDING PLATE OF THE HITCH. MAGNETS EASILY SUPPORT SWINGING STENO LORETTA TURNER.





## Permanent Magnets



WASHING MACHINE DOOR LATCH AS SEEN FROM BELOW (LEFT) AND FROM TOP. TOUCHING RELEASE BUTTON REMOVES FERRITE FROM POLE PIECES.

of a few ounces applied in removing the ferrite from between the pole pieces. Such a latch would be ideal for washing machine doors, dryer doors, refrigerator and freezer doors. These could be held firmly and strongly, yet be released with a finger touch — and wear would be nearly eliminated.

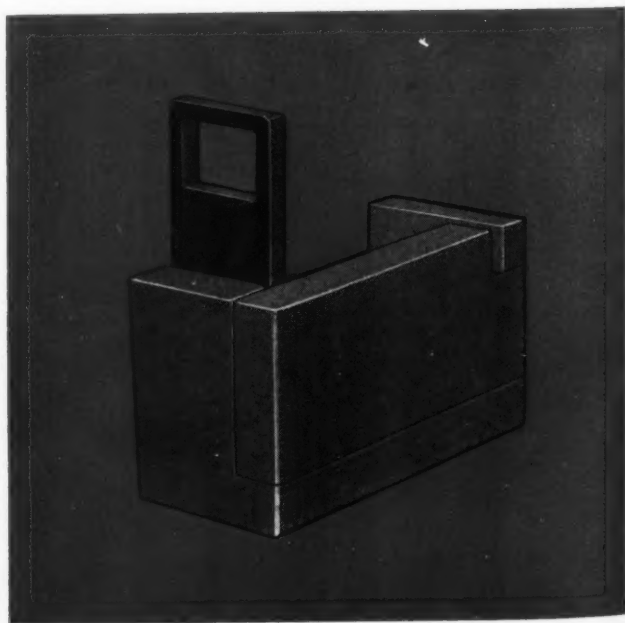
As soon as the patent application had been filed, Leco licensed the Hartwell Company, of Los Angeles, California to manufacture latches as original equipment for all types of home appliances. Recognizing the simplicity and long life of this type of latch, a major washing machine manufacturer plans to incorporate this latch in their washer and dryer models for 1956. There is no doubt that it will become a common type of latch about the home in a very few years, replacing many mechanical latches.

### The Magnetic Hitch

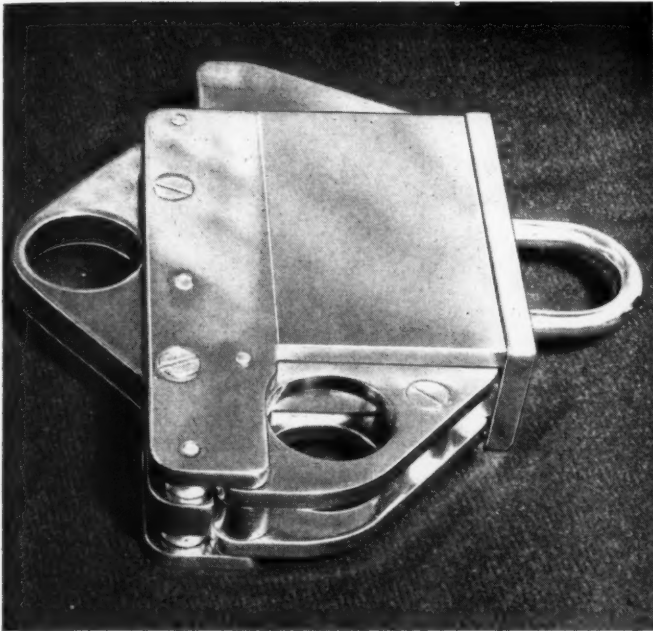
Schultz has also suggested many other uses for this device. For example, in a much heavier and stronger design this same latch can become a hitch. Four of the small pieces of ferrite working together can produce a holding force of almost 200 pounds. More of them could be combined to produce any holding force desired. Such a hitch has a number of obvious applications. As a hitch between a tractor and farm equipment, it has valuable characteristics. Suppose that a tractor is pulling a gang plow. If a conventional hitch is used, there is always danger that in rocky soil or rooty areas the plow shares will jam and the plow or the hitch will be broken. A magnetic hitch could be designed for any desired pulling power so that the hitch will simply separate when the force goes over

any desired amount. Furthermore, the farmer could hitch and unhitch his tractor to any piece of equipment without leaving the seat of the tractor. Shifting of a lever exerting no more than a few ounces of force would make or break his hitch.

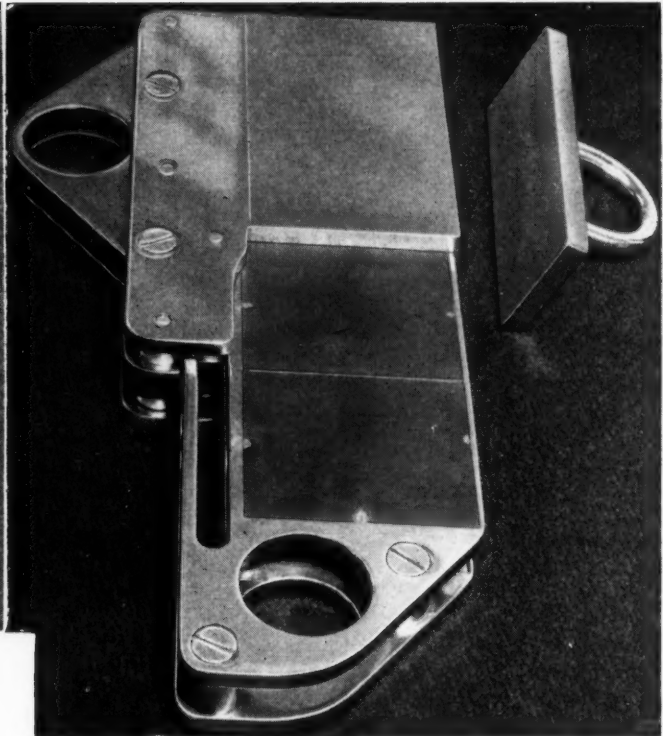
In this type of application the magnetic hitch can be thought of as a sort of nonbreakable, reusable shear pin. Anywhere in industry that there is need for a holding piece that will separate at a designed



THE PRINCIPLE OF THE MAGNETIC LATCH IS DEMONSTRATED WITH THIS MODEL. DOOR IS HELD SHUT AS



CLOSE-UP OF SAME HITCH USED IN TEST ON PAGE 55. FOUR FERRITE MAGNETS GIVE HOLDING FORCE OF 200 LB. AT RIGHT HITCH IS SHOWN RELEASED.



load, this concept would be applicable. Then, there is the added advantage of easy separation by sliding out the magnetic pieces whenever desirable.

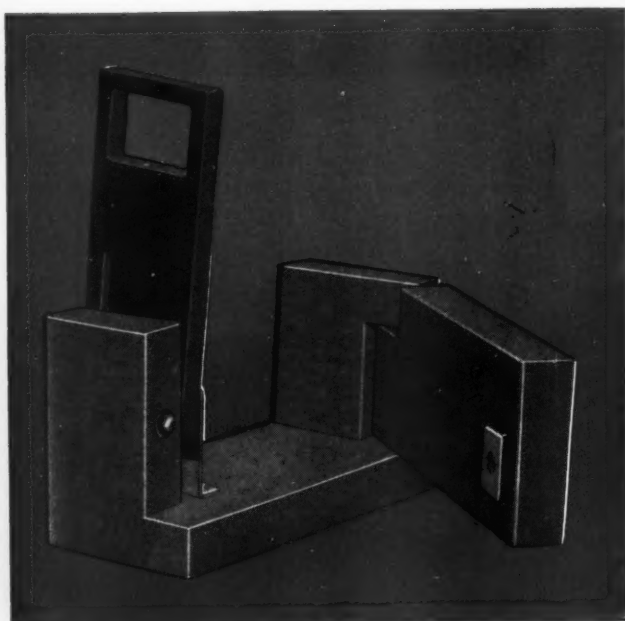
#### Other Applications

It is perfectly obvious that this "in-and-out" method of making and breaking the magnetic attraction between the pole pieces could be used to replace many electromagnet applications. The difference

would be that no current would be required to energize the magnet.

An application that offers interesting possibilities is as a device for weighing selected amounts of materials as needed for blending, mixing, or charging operations. Picture a pan hinged at one end and held at the other end by a permanent magnet with a calibrated holding force of 50 lb. A material could be loaded into the pan, and when it reached 50 lb, the holding force would be overcome, and the pan would dump into a hopper below. This could, of course, be done with any permanent magnet designed to hold with a force of 50 lb. But a conventional magnet would hold against the 50 lb—and only that amount. Using the principle of moving the magnet out from between the poles, this device could be calibrated to weigh any amount from 0-50 lb at the pleasure of the operator. He could weigh 50 lb for one batch of material, slide the magnet out the indicated amount on a scale, and weigh 35 lb, or 12 lb, or 2 lb, depending merely upon the position of the ferrite magnet with relation to the pole pieces. Since the holding force at the poles can be easily calibrated over the full range of the magnet, the possibilities of using this variable force for weighing and feeding seem unlimited.

Generally speaking, this idea makes possible the use of a permanent magnet in place of an electromagnet with all the characteristics of variable strength from zero to full force without the use of any electric current or power distribution equipment, plus the added advantage of extremely small size, simplicity, and low cost.



LONG AS FERRITE MAGNET IS IN PLACE BETWEEN POLES. REMOVING FERRITE RELEASES LATCH AND DOOR OPENS.

## ... clutches, brakes

LECO'S new sandwich construction ferrite magnets offer enormous possibilities for improved designs for clutches and brakes. The myriad of potential applications—from components of production equipment to integral parts of durable goods—provides the designer with almost unlimited opportunity. For some services, fixed force arrangements are advantageous, while in others the lever principle permitting control of the magnetic flux is the key to utility.

### Torque Limiting Clutches

Several torque limiting clutches are shown to illustrate typical designs. Fig. 7 is a pure hysteresis clutch with a single, circular permanent magnet between two pole pieces, designed to provide alternating north and south poles around the circumference. As this assembly rotates, it sets up alternating magnetization in the hysteresis ring pressed into the driven side of the clutch housing.

This unit is especially suitable for applications with heavy starting loads or frequent load reversals. Gradual acceleration of the coupling permits an electric motor to come up to speed under relatively light load. The coupling itself provides torque characteristics that are similar to those of a squirrel cage motor. It can be designed to limit the torque to a predetermined value based on the requirements of the application. Overloads merely cause increased slippage, as there is no mechanical interlock.

Fig. 8 shows another torque limiting clutch that has hardened steel pole pieces in contact with the

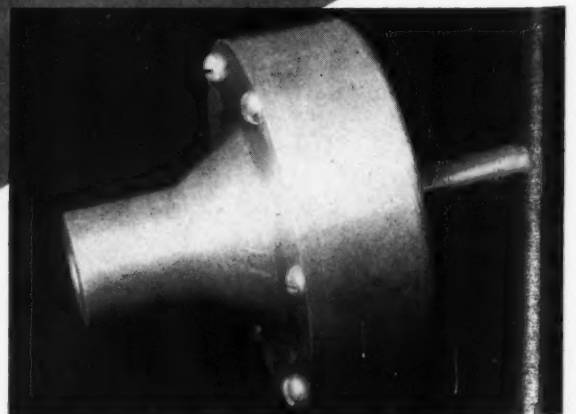
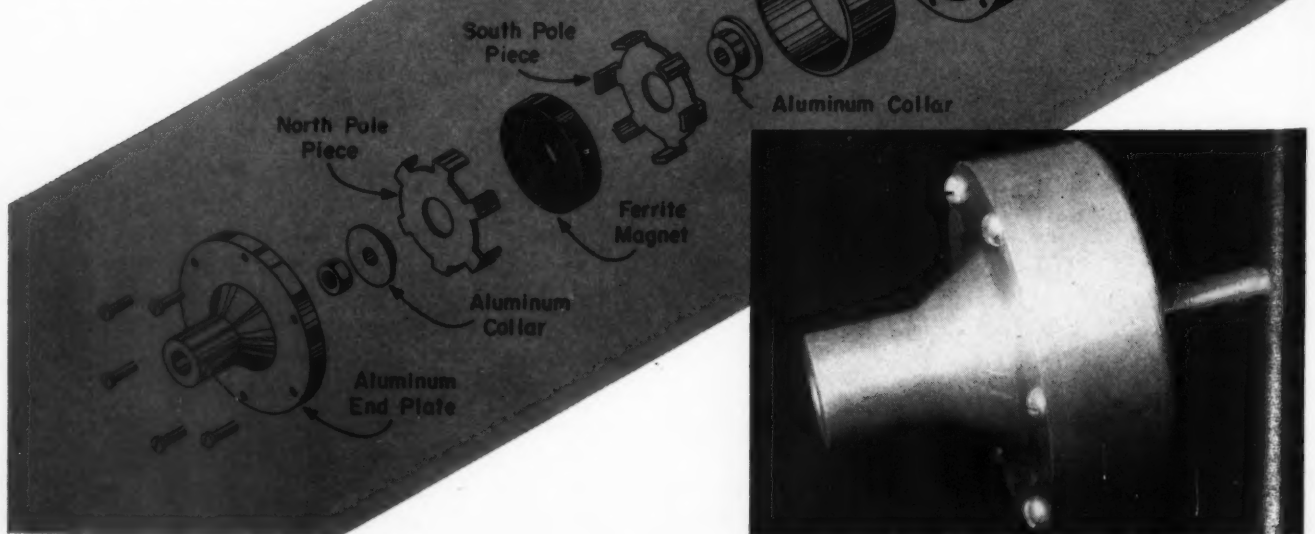
inside of a hardened steel housing. With this unit, the strong magnetic forces cause both the input and output shafts to operate at the same speed under normal load conditions. Again, slippage will occur if the design torque point is exceeded. Since each alternate magnet is set with similar poles facing each other, hysteresis adds slightly to the tractive effect during an overload condition.

### Variable Torque Clutches

While both of these clutches have fixed position magnets, ingenious designers immediately will recognize the possibilities of using movable magnets to obtain variable torque characteristics. For example, in Fig. 9 the steel pole pieces are mounted in a fixed position in an aluminum cage. The ferrite magnets are set in aluminum guide frames supported on a control spider which can be retracted axially by the control yoke.

Actually the exact arrangement of components becomes primarily a problem of mechanical linkage. The contacting surfaces can be circumferential (internal or external) or axial depending upon the

FIG. 7.— ARRANGEMENT OF PURE HYSTERESIS CLUTCH.





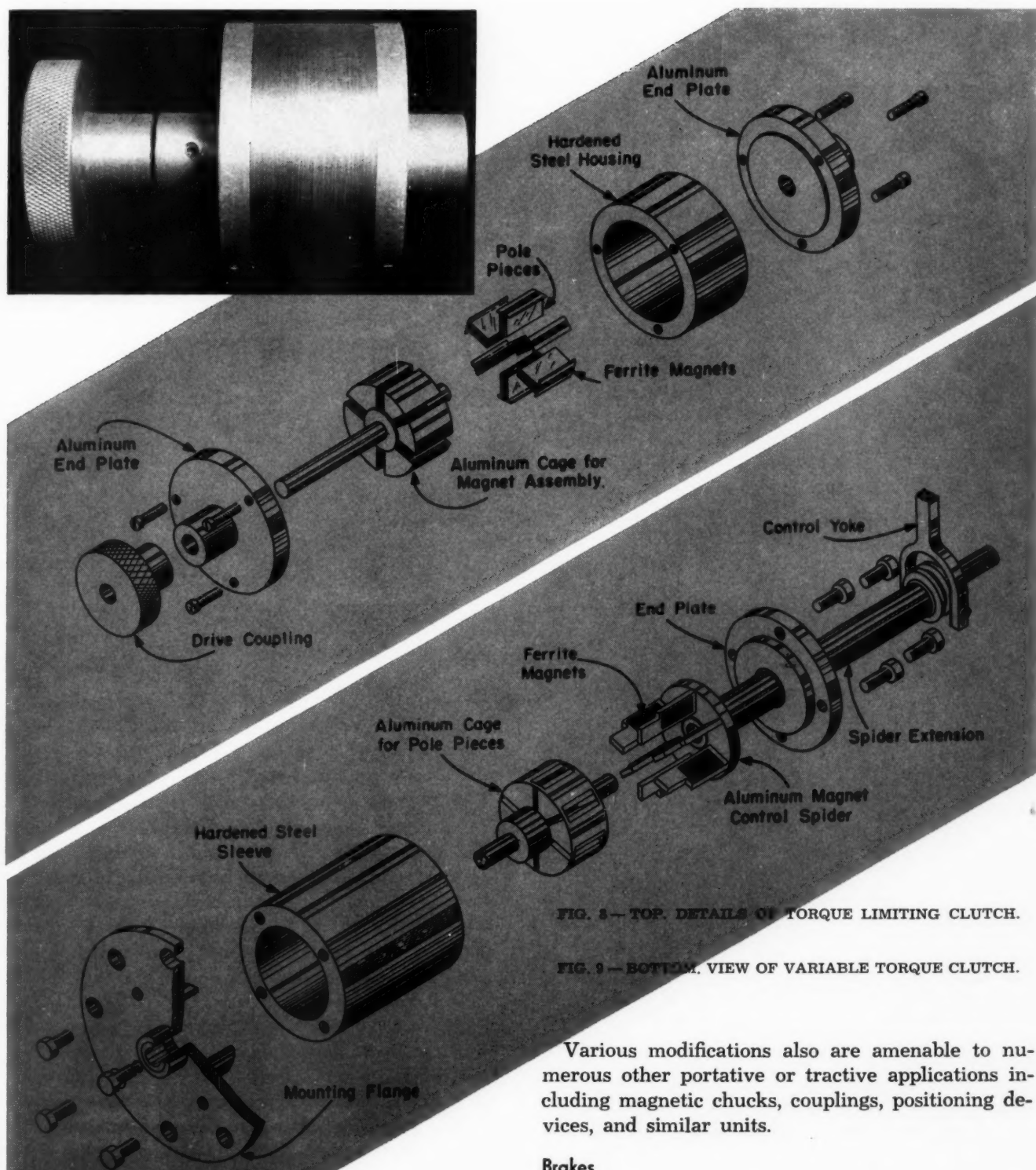
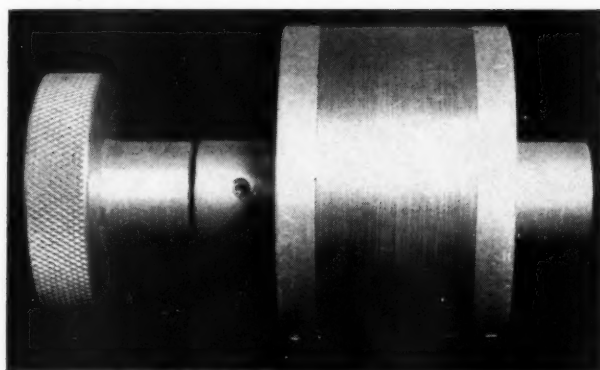


FIG. 8—TOP. DETAILS OF TORQUE LIMITING CLUTCH.

FIG. 9—BOTTOM. VIEW OF VARIABLE TORQUE CLUTCH.

Various modifications also are amenable to numerous other portable or tractive applications including magnetic chucks, couplings, positioning devices, and similar units.

#### Brakes

In similar manner these design principles can be varied to produce efficient braking mechanisms. As with the clutch, the contacting surfaces can assume any position chosen by the designer. Naturally, only the pole pieces would be involved in the frictional contact. Besides providing infinitely variable braking with minimum external effort, the ferrites are able to withstand heat up to 500 C without losing their magnetic properties. This means that good brakes could be designed while avoiding impossible cooling problems.

require ments. Multiple rows of magnets can be used for high torque services where the physical size must be held within limits. Since a very small force will position the ferrite magnets, the clutch could be operated readily from zero to full torque or even calibrated for a number of predetermined torque limiting positions.

## ... magnetos, induction generators

THE MAGNETO, as generally applied to aircraft engines, is an induction generator making use of rotating permanent magnets. These are of the Alnico type. As the magnets are rotated, a current is induced in coils in the stator. The induced current results from the magnetic flux in the coils being varied—just as in a transformer. At one moment the north pole of a permanent magnet is influencing the coil in the stator, while a moment later the north pole has moved away and a south pole moves into position. This variation of the magnetic field causes a current to flow in the stator coils.

The use of the ferrite magnets and the principle of changing the flux between the poles by the removal of the ferrite from the pole pieces offers some most interesting possibilities for magnetos or

induction generators. A stator would be made up of a series of the soft steel pole pieces arranged in pairs around the inner circumference of the stator. Between the poles would be coils to collect the induced current. The rotor would consist of a series of pieces of the magnetic ferrite so positioned that when the rotor is turned, the ferrite pieces would pass between the pole pieces of the stator.

Each time that one of the pieces of ferrite passed into and then out of a pair of pole pieces, a current would be induced in the coil. Therefore we have a generator of the induction magneto type. The possibilities are impressive. There seems little doubt but that this design would make possible the manufacture of smaller, less expensive, and simpler magnetos for aircraft or other ignition applications.

### Science Fiction?

On the other hand, there is just a possibility that much more might be expected. Suppose that for experimental purposes we were to set up a rig in which we have a pair of pole plates with a coil arranged between their ends. They are positioned so that the air gap between the two pole plates is slightly greater than the thickness of the iron ferrite piece used to magnetize and demagnetize them. This will mean that there will be no actual contact between the pole pieces and the ferrite, so there will be no contact friction between them.

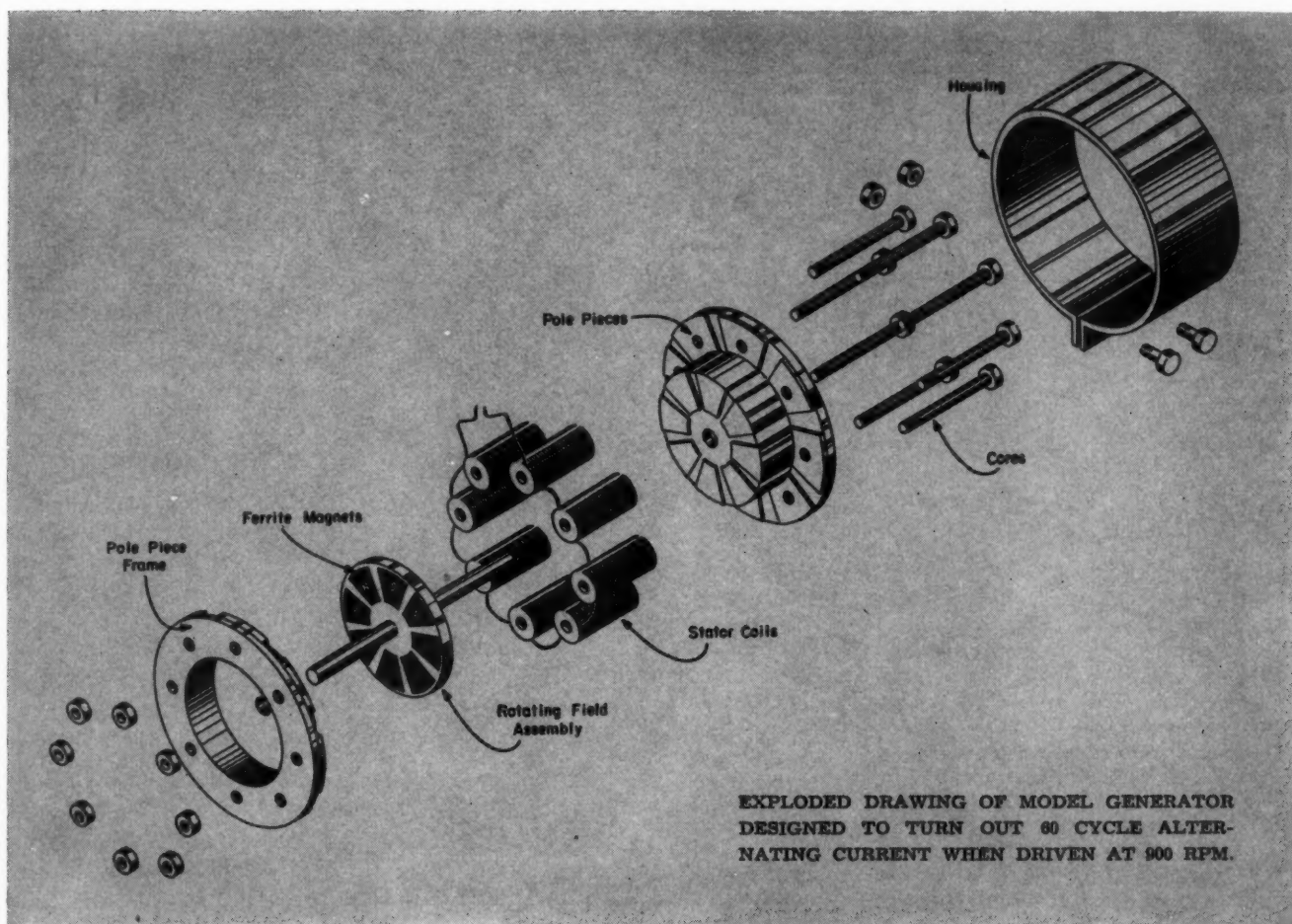
If the ferrite is inserted between the poles by moving it downward from the top, there will be a magnetic pull as soon as the ferrite enters the air gap. This pull tends to draw the ferrite into the air gap until it is centered between the pole plates. This pull amounts to a few ounces, varying from zero to perhaps four ounces when the ferrite is centered between the poles, for a magnet with a 50 lb holding force. If we were to design a spring with a force-distance curve similar to the force-distance curve for the ferrite being pulled into the pole pieces, this inward force plus the weight of the ferrite could be compensated by the opposite force of the spring. By balancing these forces, the ferrite could be moved in and out of the pole pieces with no more effort than the movement of a teeter-totter perfectly balanced at each end.

If we assume in this theoretical example that perfect balance is achieved, then current could be generated in the coil by the movement of this perfectly balanced mechanism in and out between the pole pieces. We would have here a device from which more kinetic energy would be derived than was being used to drive it. This is, of course, not



LABORATORY MODEL SHOWS GENERATOR PRINCIPLE. CURRENT IS INDUCED AS FERRITE MOVES IN AND OUT.





EXPLODED DRAWING OF MODEL GENERATOR  
DESIGNED TO TURN OUT 60 CYCLE ALTER-  
NATING CURRENT WHEN DRIVEN AT 900 RPM.

perpetual motion, in the classic sense, any more than is the use of any other natural force such as the wind, a waterfall, or heat from the sun. But so far as the practical user of any of these natural forces is concerned, it might as well be, for he does not have to handle the balancing of the energy cycle—nature does.

#### Induction Generator

For further development of this simple, theoretical induction generator, go back to the rotary design described for the magneto. If the inward pull of each rotating magnet of the rotor can be balanced against another magnet, so that as one is being pulled in between a pair of pole pieces, it is balanced by an opposite pull of another magnet, we have a balanced unit just as with the oscillating magnet and spring. However, we have the obviously more efficient rotary design.

This would mean a generator that through the use of permanent magnets in which the flux at the poles of the pole plates could be easily varied, there is the possibility of having a motor generator that would turn out more usable energy in the form of electric current than it would take to drive it.

While this seems more like fiction than fact, the other forces of nature have been put to work, and

it is just possible that the potential energy of a permanent magnet can also be made to work for man. This idea is new. It is too early to say whether it will work. Perhaps such a generator is nothing more than a very efficient design that could be produced at a low cost.

#### Revolutionary Aspects

At the moment, the National Research Council, in Washington, has a team of research physicists working on this concept, and they are making an effort to change preliminary theoretical calculations to practical applications. At least, it does no harm to contemplate a motor generator in which the usual relationship is reversed, and the motor takes less energy to drive the generator than the generator turns out.

This would mean, of course, a new industrial revolution. The thermal engines, from automobile to central station, operated on heat from combustion or nuclear reaction would be totally obsolete. Coal and oil would become petro-chemicals—nuclear reactions could be turned to more important uses than the generation of heat.

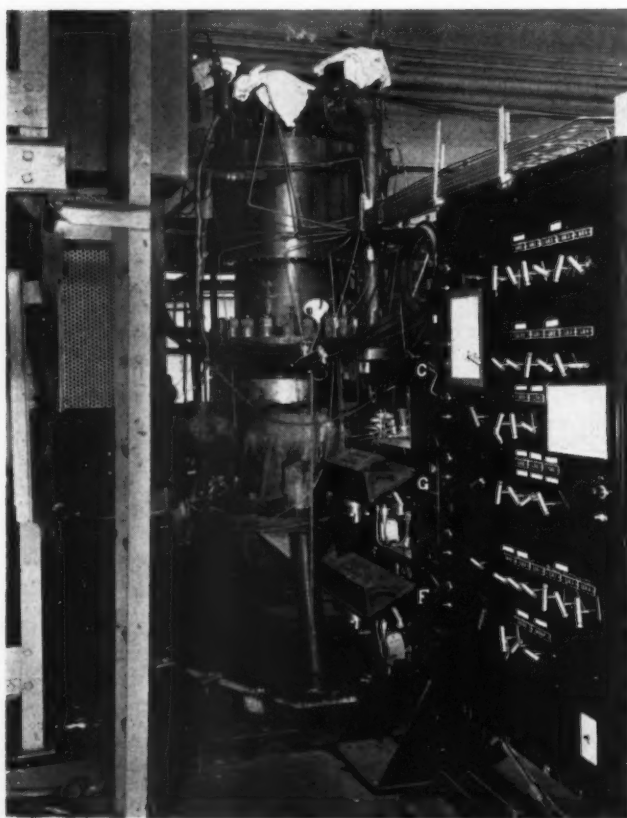
At this stage no one would recommend that you sell your utility or automotive stocks—but the possibilities are interesting. ▲ ▲



# CHARACTERISTICS AND PRICES OF CANNED MOTOR PUMPS

Manufacturer	Model	HP * (or KVA input)	RPM	Capacity Range gpm	Head Range ft	Eff. %	Max. System Temperature deg F	Max. System Pressure psi	Fluids Hdl'd	Price Range Dollars
Chempump Corp.	E	1/8	3450	1-20	1-22	Overall wire-to-water effi- ciency range 25 to 40%	450 <sup>1</sup>	150 <sup>2</sup>	Any clear liquid or light slurries	\$154-182 <sup>3</sup>
	CF	1/3 & 3/4	3450	1-53	5-94		450 <sup>1</sup>	150 <sup>2</sup>		328-729 <sup>3</sup>
	CFH	1 1/2	3450	1-53	15-150		450 <sup>1</sup>	150 <sup>2</sup>		538-794 <sup>3</sup>
	CFT	3/4 & 1 1/2	3450	1-53	5-150		700	150 <sup>2</sup>		648-1100 <sup>3</sup>
	C	1, 2, & 3	1750	1-170	10-80		450 <sup>1</sup>	150 <sup>2</sup>		482-1095 <sup>3</sup>
	CHS	5 & 7 1/2	3450	1-300	30-195		450 <sup>1</sup>	150 <sup>2</sup>		1160-1560 <sup>3</sup>
	SF	1/3 & 3/4	3450	1-53	5-94		450 <sup>1</sup>	150 <sup>2</sup>		250-550 <sup>3</sup>
Fostoria Pres- sed Steel Co. (Dynapump)	P-3100	1/8	3450	1-20	1-22	Overall wire-to-water effi- ciency range 25 to 40%	220	150	Water	\$100
Allis-Chalmers Mfg. Co.	HSCP	1-1400	900-3600	5-20,000	10-5000	to 75	1000	5000	Non abra- sive fluids	\$700- 300,000
Westinghouse Electric Co.	A-11	1*	3600	10	50	Up to 70%	600 <sup>1</sup>	2500 <sup>2</sup>	Any clear liquid or slurries	Priced from \$2500 up
	A-30	8*	3600	30	115		600	2000		
	A-150	20*	3600	180	330		650	2500		
	B-150	20*	3600	200-325	70-130		600	2500		
	C-150	20*	3600	400	100		600	2500		
	M-900	175*	1800	5300	120		605	1725		
	SFR	300*	3600/1800	5000	245		600	2000		
	D-4000	350*	3600/1800	4000	360		450	2500		
	M-8000	1500*	1800/900	17,000	360		630	2500		

1. Standard temperature limitation with Class H stator insulation. With heat exchanger, temperature limit is 1000 F (higher for special models).
2. Standard pressure limits. With back-up liner (optional) pressure limit is 300 psi. With high pressure construction, pressure limit is 1500 psi (higher for special models).
3. Price dependent on material of construction. Standard materials available are cast iron, 316 stainless steel, Carpenter 20, Monel. Also available are titanium, zirconium, and various Hastelloys.
4. All Westinghouse pumps can be had in special models that will handle up to 1000 F system temperatures.
5. These pumps can also be designed to handle system pressures up to 10,000 psi.



ALLIS-CHALMERS SEALED MOTOR PUMP DESIGNED FOR THE AEC, BEING OPERATED ON A TEST STAND.

## Specifying Canned Motor Pumps

STAFF

DESIGNERS OF CENTRIFUGAL PUMPS have been searching for years for some way to build a leak-proof pump. Before the War the need for such a pump was recognized. The chemical industry, in particular, could not always be satisfied with the results obtained using even the best stuffing boxes or mechanical seals. Litzenberg and White<sup>1</sup> listed ten conditions under which conventional sealing systems proved inadequate or troublesome: (1) High suction and high discharge pressure with small differential head, (2) High vacuum service, (3) Cycling vacuum and pressure service, (4) Pumping

<sup>1</sup>"Design and Development of Seal-Less Pumps," D. P. Litzenberg and H. T. White, *Chemical Engineering Progress*, Sept. 1954.



WESTINGHOUSE NOW HAS SEVERAL MODELS OF THEIR AEC PUMP READY FOR SALE ON THE OPEN MARKET.

valuable liquids, (5) Pumping toxic liquids, (6) Explosive vapor conditions, (7) Pumping radioactive liquids, (8) Pumping highly corrosive liquids, (9) Noxious liquid service, and (10) Pumping liquids sensitive to contamination of any type from outside the pump.

Since the pumping of radioactive liquids is only one of the listed services calling for absolutely leak-proof pumps, there had been plenty of incentive for the development of hermetically sealed pumps before any consideration was given to the needs of the atomic energy program. In fact, the engineering group that is now the nucleus of the Chempump Corporation began their experimental work in the late thirties and early forties, so their early efforts were not based on the need for leak-proof pumps for radioactive materials. That group produced its first practical canned motor pump in 1947, and they since have installed more than 100,000 throughout the country. A large percentage of these are being used to pump various types of chemicals. The currently available Chempump models are designed to handle up to 300 gpm and heads up to 195 ft.

Westinghouse also did early experimental work in the late 30's, and by 1943, had designed canned motor pumps ranging from 3 to 75 hp. Some of their original sealed motor patents go back to 1940. They

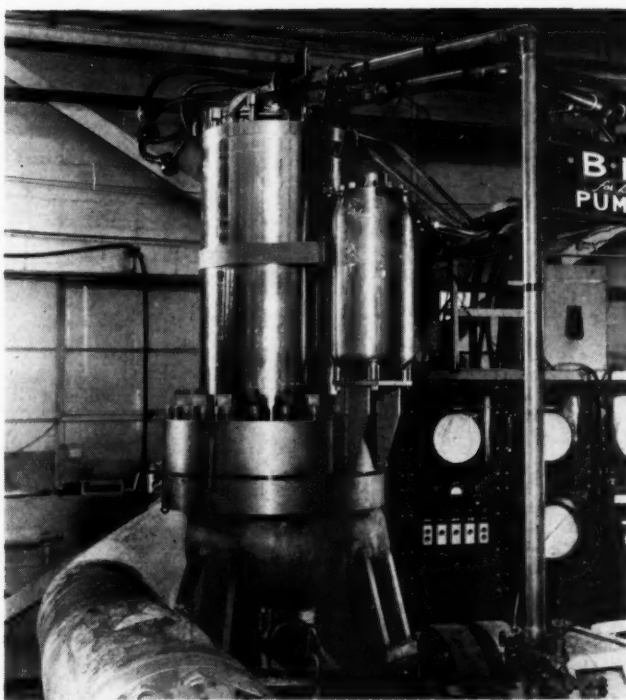
built and tested their first such pump early in 1944.

The Fostoria Pressed Steel Company, under license from the Zenith Engineering Corporation, has been manufacturing and offering commercially a small seal-less unit for several years. The pump is an axial flow type and is mounted directly in the pipeline. It is designed primarily for water circulation service, and as such has had wide appeal for contractors in the home and commercial heating field. Some 20,000 units are put into service annually.

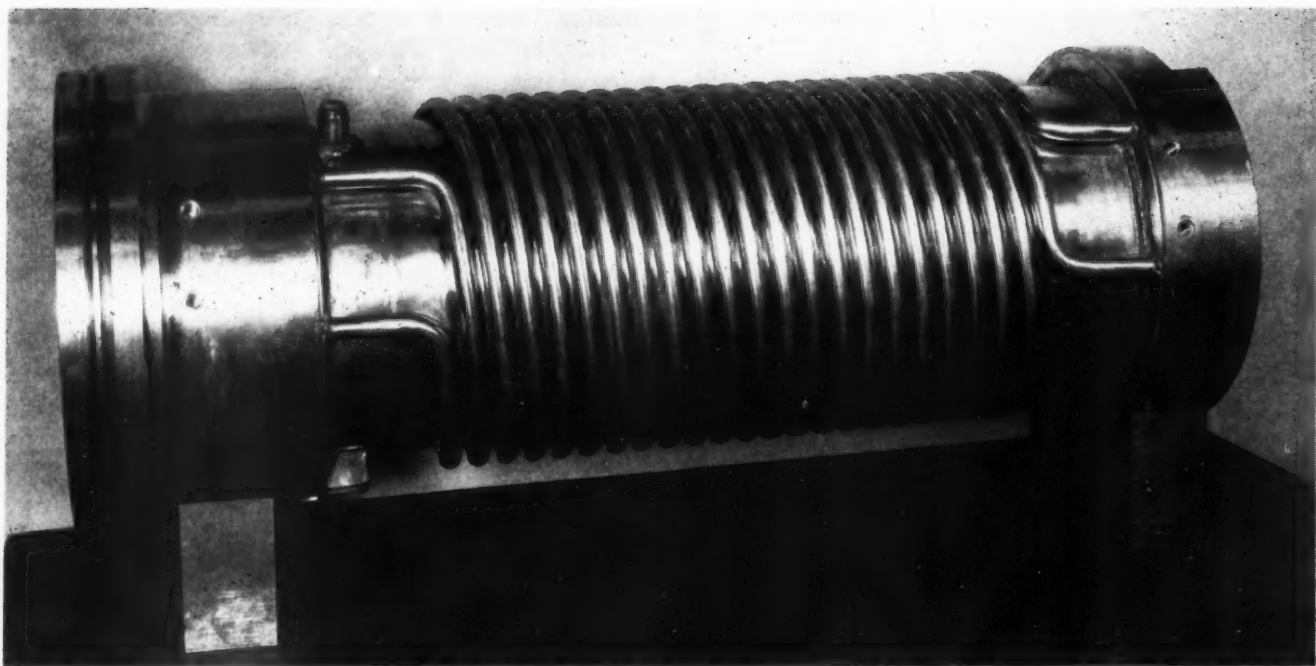
With the design of atomic power plants for the AEC, the need for a completely different class of leak-proof pumps arose. Specifically, the AEC declared their need for two hermetically sealed pumps, one a main coolant pump to circulate 4000 gpm of high temperature water at 2000 psi with a developed head of 100 psi, and the other a hydraulic service pump designed to deliver 150 gpm of high pressure, high temperature water at a head of about 120 psi. This design problem was turned over to three companies for development, Westinghouse, Allis-Chalmers, and Byron Jackson. In the spring of last year, the AEC issued a report giving design details and lists of materials for the three, fundamentally similar designs.

The Westinghouse design was chosen for the "Mark I" plant at Arco, Idaho, and the "Mark II" plant in the Nautilus. Two sizes of pumps were used, a hydraulic service pump of approximately 15 hp, and a main coolant pump of over 300 hp. Both pump designs have proven quite reliable, having accumulated thousands of hours of operating service without a forced shutdown.

The small units made by Chempump, Fostoria



BYRON JACKSON ALSO DESIGNED A PUMP FOR THE ATOMIC ENERGY COMMISSION, SHOWN HERE ON TEST.



WESTINGHOUSE MAIN COOLANT PUMP WITH CASING OFF TO SHOW STATOR PRESSURE SHELL AND COOLING JACKET.

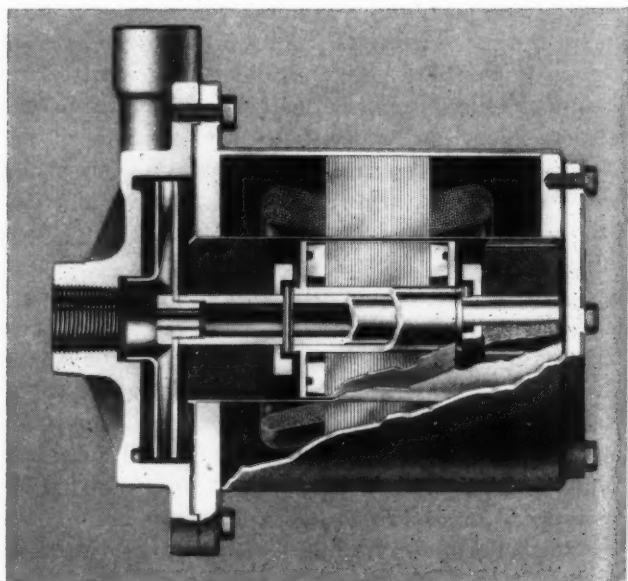
Pressed Steel, and the three designs developed for AEC all make use of the same basic idea. Rotor and stator of the driving motor are each sealed in a metal can so that the entire motor can be enclosed in the housing with the pump impeller, yet have both rotor and stator windings isolated from the fluid being pumped. This pumped fluid is allowed to fill the air gap between the stator and the rotor so that it is no longer an "air gap" but a "liquid gap."

In its simplest possible form, the hermetically sealed centrifugal pump is nothing more than a pump impeller and a canned rotor mounted on a single shaft, with the rotor then inserted inside a canned stator, the whole being encased in a pressure-tight housing. Modifications and refinements are essential before this simple design can be translated into a commercial product.

While the hermetically sealed centrifugal pump is not the only solution to the problem of leak-proof pumping, it is the most universally applicable design. The electromagnetic pump<sup>2</sup>, however, is even simpler mechanically. Pumping is accomplished by establishing a magnetic field at one point in the piping system and then applying an electric current in such a way as to create a magnetic force in the pipe in the desired direction of fluid flow. While this is simplicity itself, it is limited in application to the pumping of liquid metals or fluids in which metallic particles can be introduced without disturbing the process. Currently, it is being widely used in the pumping of hot sodium. Because of this limitation in application there is no wide conflict in *fields* of service between the electro-

magnetic and the canned motor centrifugal pumps.

Since the basic difference between a conventional centrifugal pump and a hermetically sealed pump is in the canning of the rotor and stator, it is in this design aspect that most of the original engineering work had to be done. When it is realized that the air gap in a standard squirrel cage motor varies from a maximum of 0.01 inch for a fractional horsepower to about 0.05 inch for a 100-hp machine, it is easy to understand the problem involved in canning both rotor and stator with a material thin enough to permit the maintaining of a semblance of a standard air gap,



CUTAWAY VIEW OF NEW MODEL S CHEMPUMP SOON TO BE ON THE MARKET IN 1/3, 3/4, 1-1/2, AND 3 HP SIZES.

<sup>2</sup>"Pumps — With No Moving Parts," Glenn Murphy, *Consulting Engineer*, March 1955.



strong enough to withstand the pressures involved, and sufficiently corrosion resistant to stand up to the service conditions.

Obviously, these conditions could not be fulfilled while maintaining standard air gaps, even on the larger motors. On their 3 hp design, Chempump provided a 0.02-in. liner as a cover for the stator, a 0.01-in. thick can for the rotor, and then reduced the running clearance to a minimum. This gave a total air gap of about 0.035 inch, a little more than double the conventional gap for a motor of this size. They found, however, that the change in design resulted in an additional loss of only 50 w. This, they say, is less than the power required to overcome the friction imposed by a conventional seal or stuffing box.

On the larger pumps designed by Westinghouse, Allis-Chalmers, and Byron Jackson, the cans are made of Inconel or Inconel-X and are from 0.02 to 0.025 in. thick. While this seems quite thin, it must be remembered that in these and the Chempump design the rotor can is backed up by the solid structure of the rotor itself, while the stator can is either backed by the stator for part of its length and then reinforced, or the pressure is equalized toward each end where the windings recede. Therefore, the problem here is not so much structural strength as resistance to corrosion. In actual manufacture of the AEC pumps, the rolled sheets of Inconel are cut to size, seam welded by machine, and assembled. They are then given high pressure (2000-3750 psi) leak tests using helium and a mass spectrometer.

Inconel seems to be a thoroughly satisfactory material for these AEC pumps designed to handle high temperature, high pressure water. When other fluids are to be pumped, other materials may be required. Chempump engineers have tested titanium, Hastelloy, zirconium, stainless steel, Invar, and Monel, as

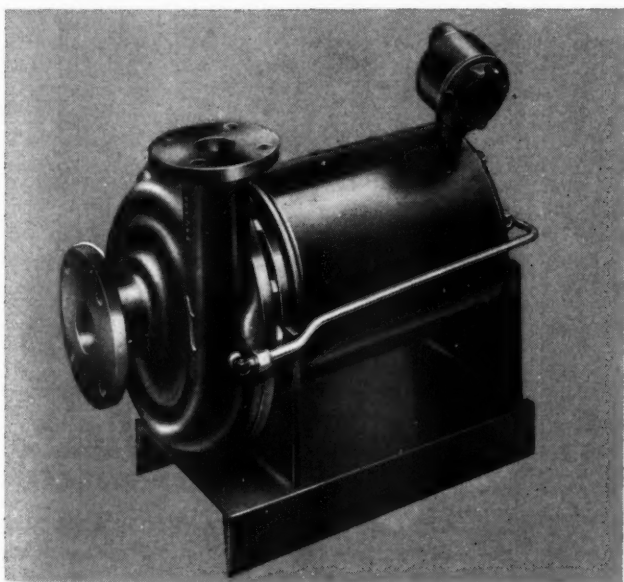
well as Inconel. All of these metals as well as some plastics have been used successfully.

Another problem in the design of hermetically sealed pumps is the finding of a means to remove the heat from rotor, stator, and bearings. This is generally accomplished by circulation of a cooling fluid. If the fluid being pumped is cool, it can be used as the cooling fluid by allowing it to circulate freely around the stator, rotor, and bearings. If the pumped fluid is hot, other cooling methods must be used. On the Westinghouse pump for AEC, cooling water is circulated around the stator, while the rotor is cooled by the primary water circulating in the air gap. This water is under system pressure but is separated from the water being pumped by a thermal barrier. It is cooled in a small heat exchanger so that it stays at a temperature of about 150 F, a satisfactory operating temperature for the rotor. Chempump models with small external heat exchangers are operating on hot fluids at temperatures up to 1000 F.

On the larger pumps, bearing design required considerable research. These problems were solved by adjustment in impeller position and the use of special bearings of nitrided, ground, and lapped stainless steel running in journals of the same material or of Graphitar, a carbon graphite compound. The Allis-Chalmers pump is unique in that it makes use of pressurized, or hydrostatic, bearing lubrication. The lubricant is, of course, the high temperature, high pressure water of the system. It is supplied to the bearings by an auxiliary impeller.

Of greatest importance to the consulting engineer is the question of availability and price. Currently, only Chempump and Westinghouse have announced a full line of pumps available from stock. Chempump has been producing standard models in the small sizes (1 to 300 gpm) for several years, and the Westinghouse line, (1 to 17,000 gpm) was just announced this spring. Fostoria has offered its seal-less water circulating pump since 1953. The Table shows all necessary design specifications and price ranges. Even a hasty glance at the prices indicates that these are not pumps to be specified for every plant pumping job. They can be justified only when conditions demand zero leakage. But with the growth of the chemical and atomic industries, such demands are becoming more and more common. One electronic tube manufacturer admits a saving of \$1500 in 10,000 hours of operating time in the pumping of potassium silicate with a  $\frac{1}{3}$  hp hermetically sealed pump. The savings came from elimination of shaft replacement and stuffing box maintenance.

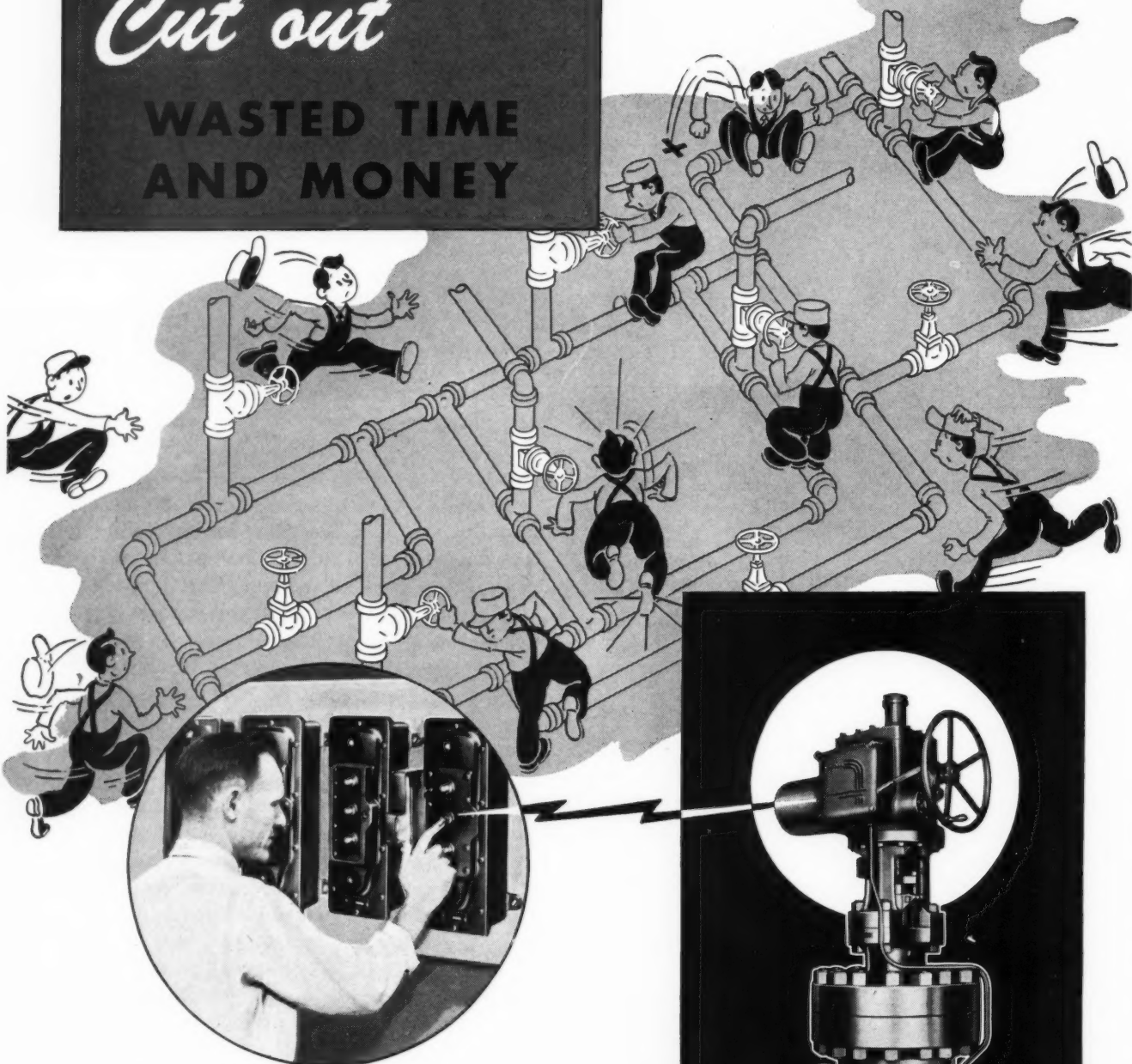
On a new line being brought out by Chempump, new methods of construction make possible a 20 to 25 percent price reduction on their  $\frac{1}{3}$  and  $\frac{3}{4}$  hp models. Also, a new bearing design gives 400 percent more bearing area, while wetted part structures can be clad with corrosion resistant materials such as Hastelloy, zirconium, and tantalum.



THIS MODEL CHS CHEMPUMP, 5 AND  $7\frac{1}{2}$  HP, WILL HANDLE HEADS TO 195 FT AND CAPACITIES TO 300 GPM

*Cut out*

**WASTED TIME  
AND MONEY**



**...just push a button  
and leave the rest to**

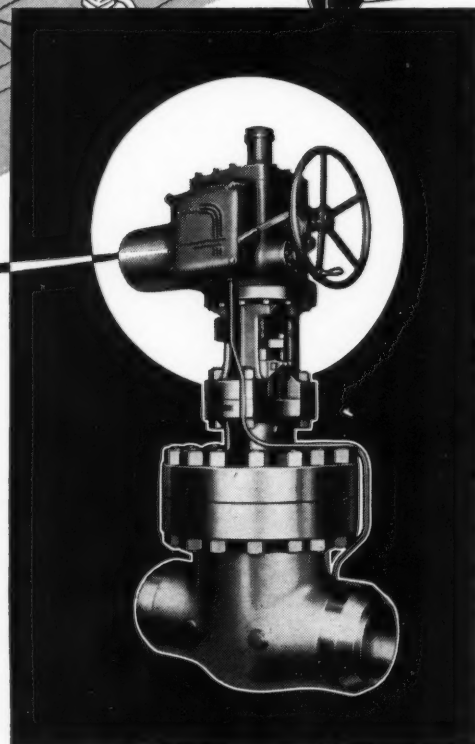
***LimiTorque***

## **Automatic Valve Controls**

Think of the time, labor and money that can be saved by opening and closing valves in remote, inaccessible or distant locations with LimiTorque Valve Controls.

LimiTorque not only operates valves at the speed required, but it "limits the torque" applied to the valve operating parts and thus prevents damage to stems, seats, discs or gates . . . and too, the handwheel "cannot rotate" when the valve is being motor-operated.

Send for Catalog L-54,



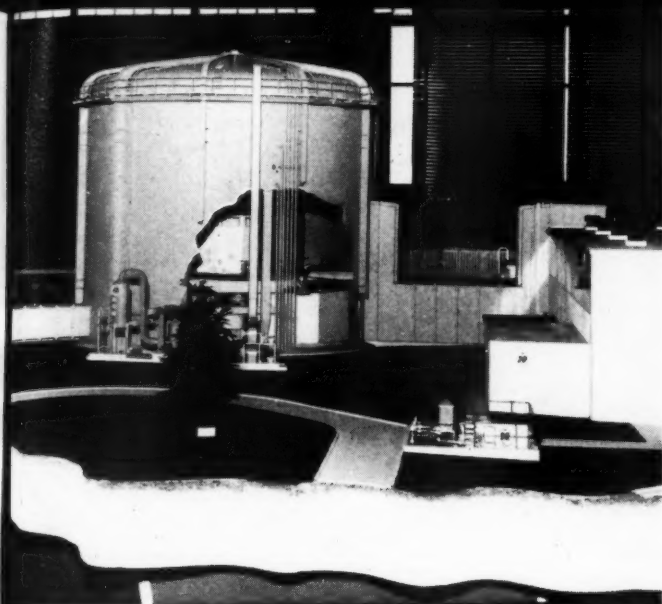
**PHILADELPHIA  
GEAR WORKS  
INCORPORATED**

**ERIE AVE. AND G ST., PHILADELPHIA 34, PA.**

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.  
BALTIMORE • CLEVELAND

LimiTorque Corporation—Philadelphia

Industrial Gears & Speed Reducers • LimiTorque Valve Controls  
Established 1892



The Atomic Conference is at the halfway mark as this report is written. Representatives in the nuclear energy field from all over the world are in attendance. While the nuclear scientists and engineers hold sway at the Conference in the Palais des Nations, the commercial people are showing their wares at the Exposition in the Palais des Expositions. Here is a firsthand account of these activities for CE's readers, as reported by our European Editor, on the scene of the conference, in Geneva.

MODEL OF BRITISH HEAVY WATER REACTOR AT HARTWELL.

CE attends ...

CE exclusive

# The Geneva Atomic Conference

FRITZ HIRSCHFELD, European Editor

EVERY ASPECT of the First International Conference on the Peaceful Uses of Atomic Energy presently being held in Geneva, emphasizes the importance of this subject to the nations of the world. Top-level scientists, physicists, nuclear engineers, government officials, politicians, and businessmen are rubbing shoulders in the corridors of the Palais des Nations (the old League of Nations building). In one short day at the Palais, I had my toes stepped on by Dr. I. Rabi, Nobel Prize-Winner, while watching a film on the Russian nuclear power plant at the Russian exhibit; shared the sugar bowl at the snack bar with Dr. Willard Libby, Commissioner of the U.S. Atomic Energy Commission; rode in the elevator with Mr. Walker Cisler, President of the Detroit Edison Co.; and fought for a paper at the news stand with Dr. Homi Bhabha, Indian President of the Atomic Conference.

No expense or effort seems to have been spared to make the government-sponsored exhibits at the Palais appealing and technically complete in illustrating the progress that has been made in the peaceful utilization of atomic energy. The U.S. by no means dominates the scene. The English, the French, and even the Russians have impressive displays that are attracting a great deal of attention. The smaller countries must be given credit for their efforts to participate to a degree commensurate with their more limited resources and progress in the development of the atom.

The papers being presented before the Conference have been carefully selected and contain valuable

technical information. They represent primarily the work and interests of scientists and researchers. Very few of the papers deal with the experiences of private industry in the nuclear field.

The public relations and communications facilities are excellent. All over the city of Geneva posters call attention to the Conference and Exposition. News releases and texts of the papers presented before the Conference are given to the press promptly. Hundreds of newspaper men, photographers, and TV technicians are in Geneva—more than enough to fill the vast press galleries of the Assembly Hall, with some left over. There is no doubt that this Conference will be fully covered in the publications of every country involved.

Geneva is in the French part of Switzerland at the lower end of Lake Geneva. The people are honest, hard-working, and completely indifferent to the comings and goings of international conferences and international figures. Prices are high, but the folks here are comparatively well-off and do not need to prey on tourists through black-market transactions or jacked-up prices. The weather is extremely cool with coats and pull-overs needed during the day and blankets a necessity at night.

At one end of the city, in a beautiful wooded tract overlooking the lake, are the white marble buildings of the old League of Nations, referred to here as the Palais des Nations.

The Palais was designed with this kind of international conference in mind. Inside the building in the center is the large assembly hall. Below the



speaker's platform are tables for the recording secretaries. On the main floor are rows of desks with comfortable padded seats for the delegates. A spot in the center of the floor is reserved for a movie projector and TV equipment. Along both sides of the room are glass-enclosed booths for the translators. Above these booths are the press galleries. Visitors occupy a second level of galleries. Each seat has a set of headphones with a selector control for choosing the appropriate language—the original language of the speaker amplified directly, and translations of the others, English, French, Spanish, or Russian. No matter what your nationality or what language the speaker uses, everybody can listen in.

The general public is not admitted to the Palais. The official delegates wear badges with their names (but no titles) and the country they represent. Press representatives and unofficial observers have only an identification card to show on request.

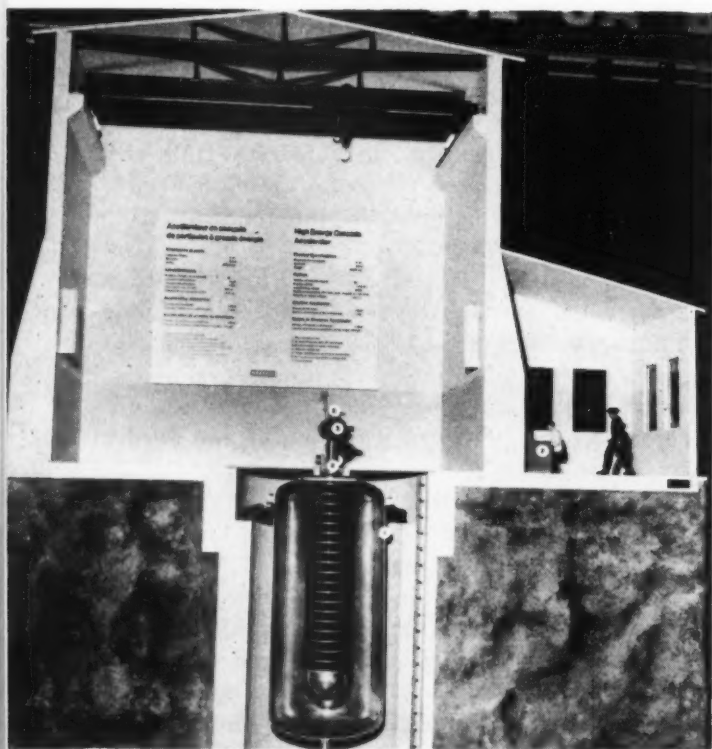
Ranged outside of the main assembly hall are various smaller conference rooms, service facilities, and library and office space. Certain of these areas have been set aside for the exhibits of the different countries participating in the Conference. Generally speaking, these exhibits are geared for the technical people who have some background in the nuclear field. The purpose of the exhibits is to give the scientists a basis for comparing the progress of nuclear advances in the major countries. There is no effort made to commercialize or to try to sell any products at the exhibits. Models, flow charts, samples of ores, selected items of equipment, demon-



MORSE, OF NATIONAL RESEARCH CORP. DISCUSSES BUSINESS PLANS WITH TWO POTENTIAL CUSTOMERS.

stration boards or instrument panels, photographs and films are the media used in these presentations. A booklet describing the display is given to each visitor, and every exhibit is marked with an explanation in three or four languages. Interpreters and guides are also available.

The countries with government-sponsored exhibits at the Palais include Belgium, Canada, U.S.A., France, United Kingdom, Scandinavia, and Russia. The American exhibit is very comprehensive and includes a model of practically every major reactor built or being built in the States. There always seems to be a crowd looking over this display and

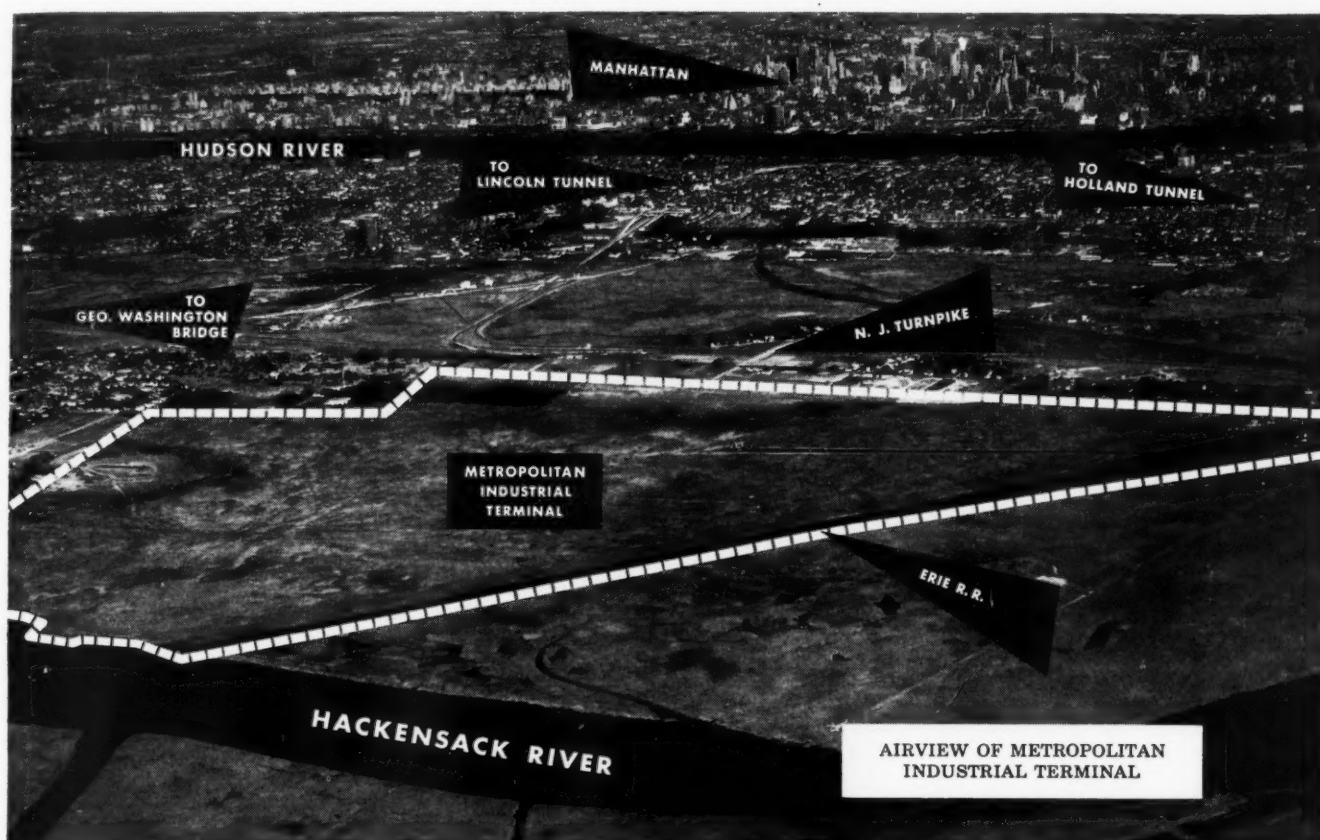


SWISS FIRM SHOWS CUTAWAY MODEL ACCELERATOR.



G.E. MODEL OF THE COMMONWEALTH EDISON REACTOR.

## YOUR NEW PLANT WILL GROW IN THE ERIE AREA



## 1000 ACRES FOR INDUSTRY...MINUTES FROM MANHATTAN

*...served by the dependable Erie Railroad*

**This choice planned industrial center, in Secaucus, N. J., has recently been made available to expanding and relocating industries. As a plant site area, it offers a combination of advantages of importance to many industries. Check these advantages . . . then mail the coupon below for detailed information.**

## 7 minutes to mid-Manhattan; express highway service to all points

## Erie railroad sidings to sites

### All utilities and site improvements

## America's largest pool of labor, clerical and engineering talent

## Good community life and fine homes nearby

## Favorable New Jersey tax structure

**Main-line Erie Railroad service to the nation's largest single market, and unsurpassed export-import and docking facilities in the Port of New York.**

# Erie Railroad

**Serving the Heart of Industrial America**



A detailed map of the Erie Railroad system. The main line runs from Buffalo, New York, through Jamestown, Meadville, Salamanca, Bradford, Olean, Hornell, Elmira, Corning, Binghamton, and Port Jervis, ending in New York City, New Jersey. Branch lines connect to Cleveland, Ohio; Akron, Ohio; Lima, Ohio; Marion, Ohio; Youngstown, Ohio; Dayton, Ohio; Cincinnati, Ohio; Pittsburgh, Pennsylvania; Scranton, Pennsylvania; Paterson, New Jersey; Newark, New Jersey; and Jersey City, New Jersey. The map also shows the railroad's proximity to Lake Erie and the Hudson River.

**D. M. Lynn, Assistant Vice President  
Industrial Development—Room 524-D, Erie Railroad  
Midland Building, Cleveland 15, Ohio**

Dear Sir: Please furnish us, in strict confidence, additional information about the plant sites described above.

Name \_\_\_\_\_

*Title* \_\_\_\_\_ *Company* \_\_\_\_\_

**Address** \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



VITRO CORP. OF AMERICA OFFERS CONSULTING WORK ON FUEL PROCESSING OR REACTOR DESIGN.



UNION CARBIDE EXHIBIT TELLS OF THAT FIRM'S ACTIVITIES IN ALL FIELDS OF ATOMIC ENERGY.

the consensus is that it is the best exhibit of all those at the Atomic Conference.

Outside of the main building there is a specially erected wooden structure housing the U.S. Research reactor that was recently sold to the Swiss Government for experimental purposes. This operating reactor (10 kw) has turned out to be a very popular exhibit—open to the general public.

Consulting engineers interested in obtaining detailed accounts of the proceedings at the Conference will be able to get copies of all the papers presented at the Conference. They will be made available through the major libraries and research centers by the United Nations.

On the other side of town from the Palais des Nations is a modern, armory-type building called the Palais des Expositions. This houses the commercial exhibition of nuclear equipment and services being

shown in conjunction with the Conference. The Exposition is open to the general public and admission is charged. Floor space is rented to exhibitors just as at other trade fairs.

I found the Exposition, in contrast to the Conference, particularly pertinent from the standpoint of the consulting engineers' interests. Here are private companies, without government sponsorship or backing, investing a lot of time and money in an effort to make contacts and to get their foot in the door of the international market.

Since building a nuclear power plant, selling an atomic research reactor, or supplying nuclear needs in any of a dozen fields is big business, it is not surprising to find the top brass manning the booths. Presidents, managers, chief engineers, and department heads were at most of the American and English exhibits. While none of these men admitted they were happy to be away from their office work for two weeks, they all agreed that the foreign delegations they contacted along with other highly-qualified and responsible men made the mission worthwhile. Although it is highly improbable that a nuclear power plant can be sold across the counter at a trade fair, by establishing contacts and lines of communications with people who would otherwise be very inaccessible, they are laying the groundwork for future sales.

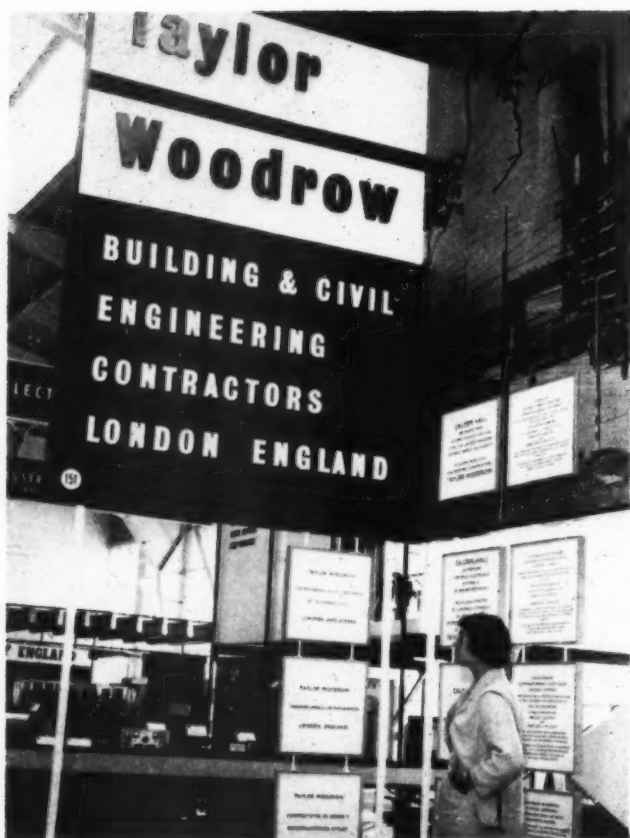
To "make contacts" and to "see and be seen" is a common aim at the Exposition. However, there are some very noticeable differences in techniques. The Americans are out to create goodwill and do a public relations job—which they seem to be successfully doing. The English, on the other hand, are out to sell equipment and to come home with definite orders on the books. The final results of these different attacks are yet to be seen.

The countries exhibiting at the Exposition are Germany, Belgium, U.S.A., France, Great Britain, Italy, Liechtenstein, Netherlands, and Switzerland. The English firms, in my opinion, have the best looking exhibits and appear to have put more effort into the preparation for this show than any of the others. The smaller countries are displaying a great deal of conventional equipment—instruments, mining tools, electronic devices—that have nuclear applications or that can be adapted for nuclear work. Some of the displays are strictly visionary, as the Swiss exhibit, with grandiose schemes for nuclear developments. The French and Italians, while they are larger countries with greater resources than Switzerland, are also in the dream category when it comes down to actually selling a complete nuclear project rather than just a few research instruments or mining tools.

So the commercial competition is really between ourselves and the British, with the British perhaps slightly in the lead. One reason the British appear to have a headstart on us in their commercial efforts







TAYLOR WOODROW ARE THE CIVIL ENGINEERS AND CONTRACTORS NOW BUILDING ENGLAND'S CALDER HALL.

is that the British Government has lifted some of the security restrictions on the sale of radioactive materials and nuclear equipment and has encouraged private firms to enter the foreign market. Quite a few of our American representatives told me that until the AEC (Atomic Energy Commission) makes some definite decisions as to just which items fall under security classifications and which can be freely placed on the commercial market, it will be difficult to successfully go after business on an international basis. It seems almost a certainty that as a result of the present Conference and Exposition there are going to be revisions of the AEC's policies.

One country conspicuous by its absence at the Commercial Exposition is Russia. In spite of Russian's boasting that they were the first to build an atomic power station, they do not seem to be in a position to market their know-how or their products. However, the Russian delegates made the rounds of the stands and picked up all the literature.

#### Comments and Opinions

Mr. A. Radkowsky, a nuclear physicist on the staff of Admiral H. C. Rickover in the Naval Reactors Branch of the AEC, who is acting as Admiral Rickover's official representative at the Conference, thought that quite a bit of technical material was being held back by both the U.S. and Russia. (It

must be remembered, of course, that he is working on a military program which is undoubtedly more advanced than the peaceful applications of atomic energy). He was not deeply impressed, either, by what he referred to as the "pipe dreams" of some of the nuclear energy programs of the smaller countries. But there was no denying that the cordial and friendly spirit of the Conference had created goodwill and would improve the chances for more emphasis on peaceful uses of atomic energy.

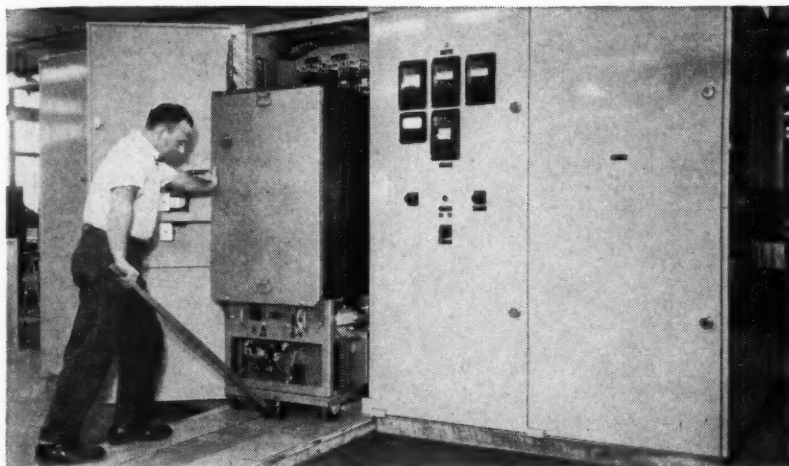
Over at the Exposition, Mr. Richard Morse, President of the National Research Corporation, is satisfied with the daily contacts and inquiries that come to his booth. National Research is primarily interested in selling equipment (high vacuum furnaces, vacuum pumping systems), and in order to help develop the foreign markets, the firm plans to offer its consulting and advisory services as a means of broadening their own future sales potential. Mr. Morse, like most of the other qualified technical people, feels that the need for nuclear energy in foreign countries is much greater than in the U.S. because of their lack of low-cost fuel resources. Mr. Morse and his firm are among the few representatives at the Exposition trying to capitalize on this apparent need by actively looking for nuclear consulting and engineering assignments.

John Cartinhour, Manager of the Nuclear Energy Department at Foster-Wheeler, brought up the point that before Foster-Wheeler could actively start selling their power reactors there would have to be some rulings by the AEC. Mr. Cartinhour looks for a test case before the AEC to help clear the way for a real sales effort abroad.

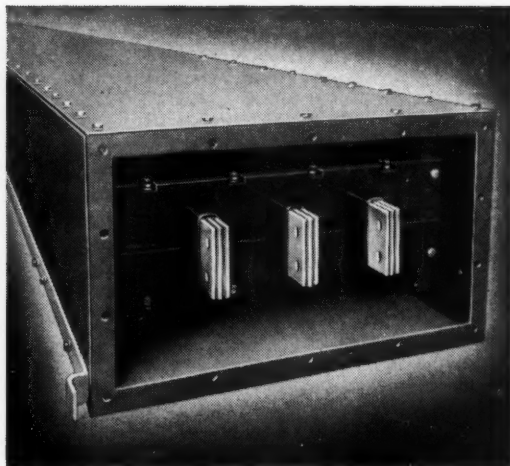
#### Valuable Contacts

Newton J. Steers, Jr., President of the Atomic Developments Mutual Fund, Inc., is frankly amazed at the size and diversity of the exhibits at the Exposition. He does not feel that there will be many direct orders placed, but certainly valuable contacts can be established that will become good business prospects for the exhibitors. One of the main reasons that Mr. Steers felt that his company should take part in the Exposition is the presence in Geneva of practically all officials and representatives connected with atomic programs in every nation. These men will undoubtedly pass through the Exposition, and Mr. Steers believes that this is a good opportunity for a friendly chat and lining up a future contact.

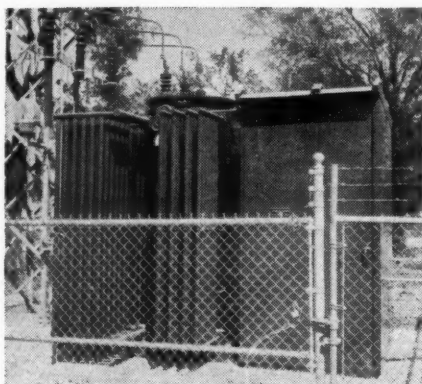
When I asked Mr. Steers if he noticed the commercial aspect of the British exhibit as compared with our own, he said that it was to be expected since the British Government was encouraging its firms to go after sales while the U.S. Government was leaning over backwards to avoid any semblance of so-called "dollar diplomacy." As to the business prospects for the Mutual Fund, Steers told me that



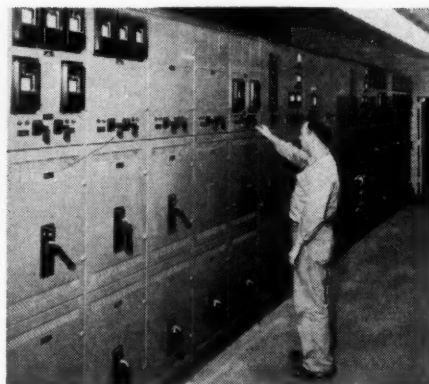
**Metal-clad switchgear.** Horizontal drawout air circuit breakers in rigid, all-welded enclosures. Available in ratings from 2400 v through 15 kv—50 through 500 mva interrupting and 2000 amp continuous.



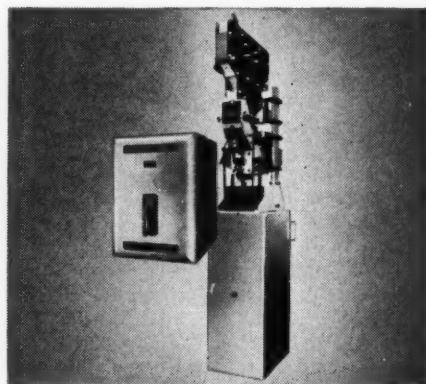
**Nonsegregated phase, metal-enclosed bus.** For switchgear connections. In ratings 600 v through 6000 amp; 5, 7.5 or 15 kv through 5000 amp.



**Unit substations.** I-T-E primary and secondary unit substations can be supplied for any application—indoor and outdoor—and in any standard rating.



**Low voltage switchgear.** Ratings through 600 v a-c, 250 v d-c, 6000 amp continuous, 15,000 through 150,000 amp interrupting.



**Individual breakers.** I-T-E large air circuit breakers are available in a wide range of types and ratings, 600 v a-c, 250 v d-c, 750 v d-c.

## NEW CONSTRUCTION ECONOMY TIP: BUY AN I-T-E "POWER PACKAGE"

**Coordinated engineering, delivery and installation means a better investment**

An I-T-E "power package" includes the complete power handling facilities you need for a new construction project, building addition, or simple expansion of electrical service—one unit or a complete system for application from generation to end use. You save many ways:

**Sound planning.** Talk with your local I-T-E application engineer about your general power requirements before you build. He'll work with you to determine the equipment needed to assure complete protection with greatest economy in total investment, operating costs, and construction time.

**Easier installation.** Before you begin construction, I-T-E will supply you with

arrangement and channel base drawings. Equipment is factory assembled, tested and ready to install. Standardized frames and panel elements assure that future additions to your switchboard will match and line up.

**Coordinated delivery.** Shipments are made from I-T-E according to a predetermined schedule. Each part of the complete "power package" is delivered to the job when needed. This saves delays and eliminates inconveniences.

**Assured performance.** Since I-T-E will supply all equipment—pre-engineered—you are saved the work of coordinating equipment of different manufacture. You can be sure that the separate parts of an I-T-E "power package" will fit and function together.

For details, contact the I-T-E sales office nearest you—look in your classified directory under "Electric Equipment." I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.



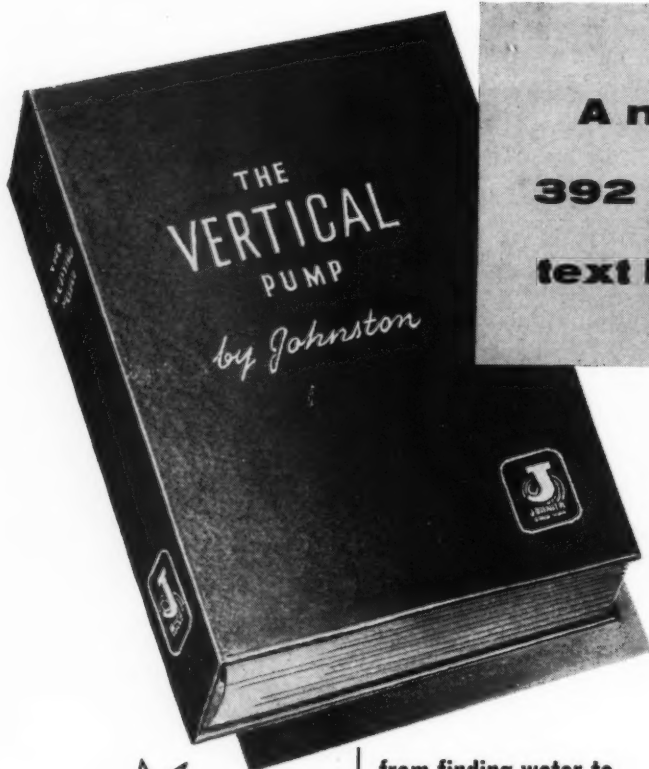
**I-T-E CIRCUIT BREAKER COMPANY**  
Switchgear Division



**Just off  
the press!**

after 4 years  
of research

**A complete work  
on the Vertical  
Pump Industry**



**A new  
392 page  
text book**

**Only  
\$10.00**



**all steps**

**from finding water to  
pump selection covered.  
Plus important industrial  
application data.**

This complete volume covers the finding and development of ground water resources, geology, drilling methods, well logging, construction, design and performance characteristics of vertical turbine, mixed flow and propeller pumps. Practical applications and vertical pump selections as related to industrial uses are thoroughly covered in this authoritative manual.

Leading engineers from industry and top scientists from many of the largest Universities and colleges in the U.S. contributed to this book. Every user and prospective vertical pump user will find this book unequaled anywhere. Just fill in and mail to us the coupon below with a \$10.00 check or money order (plus sales tax where applicable).



**JOHNSTON PUMP COMPANY**

Bin "K," Pasadena 15, California CE-95

Please send me your authoritative 392-page Pump Manual. My check for \$10.00 (plus sales tax where applicable) is enclosed.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

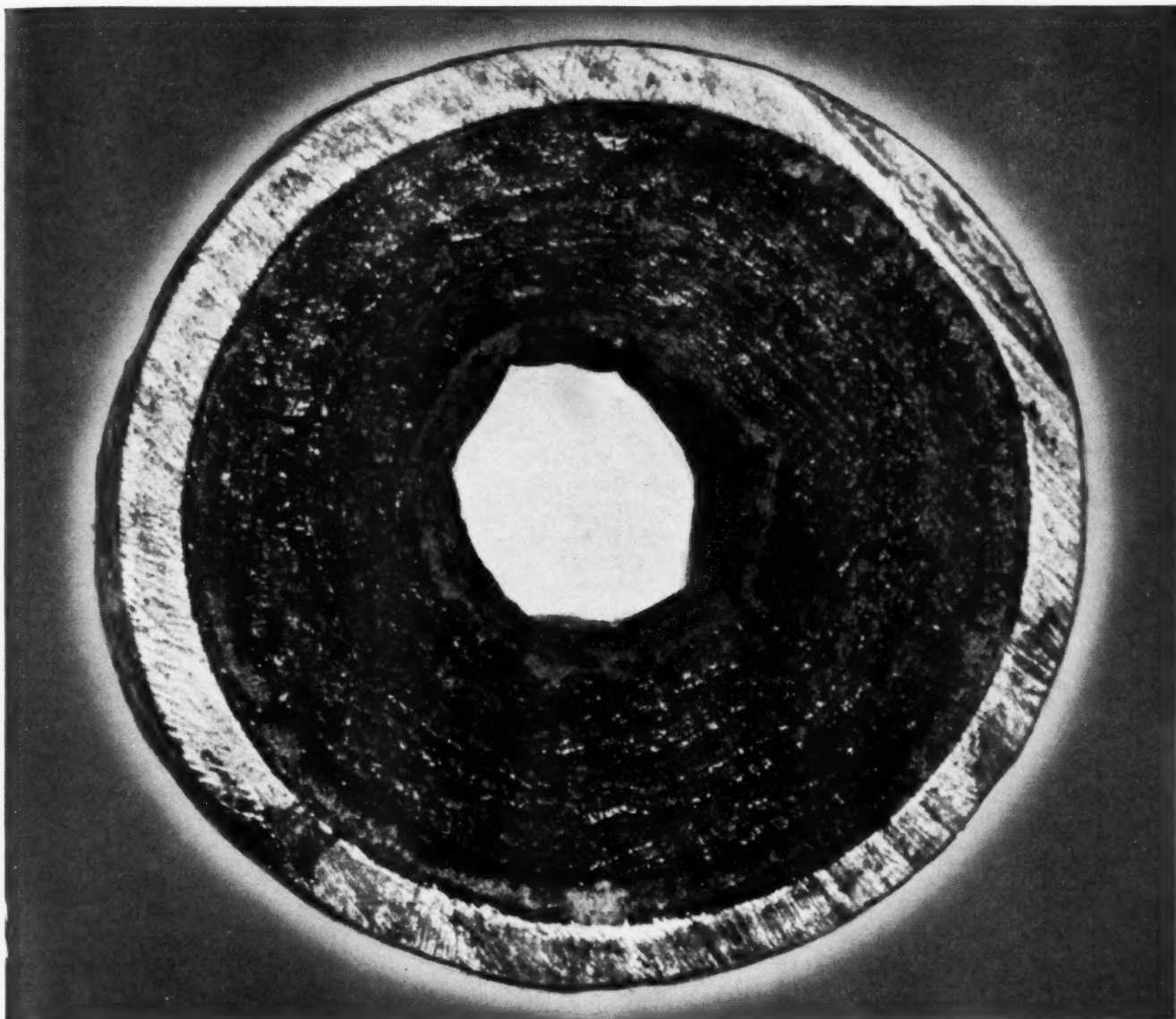
\$750,000 worth of stocks in the Fund were sold in a few days, when offered on the Amsterdam exchange. That alone, thinks Steers, is a pretty good indication of the serious interest in the investment opportunities that atomic developments in the international field have stimulated.

At the GE display, Vice-President and General Manager Francis K. McCune, O. B. Falls, Manager of Marketing, and Bruce Prentiss, Manager of Atomic Power Studies, were on hand to discuss GE's program with visitors. McCune commented that the Exposition is a very intelligent exhibit and that the papers presented at the Conference are of excellent caliber. Mr. Falls added that most of the people visiting the GE display have a direct interest in atomics—the interest centering primarily on research and power reactors. Regarding the equipment displayed, Falls ventured the opinion that there is a considerable variation in the quality of materials but he did not elaborate. GE, as a result of this Exposition, will alert its sales organization to follow on the leads and contacts initiated here.

Westinghouse is equally well represented. Charles Weaver, Vice-President of the parent company, J. H. Compton, Vice-President of the Westinghouse Electric Co. of Europe, and F. J. Ullman, Regional Supervisor for the European company, were all present. Compton is not overly impressed with some of the extravagant claims made by competitive foreign exhibitors. He prefers to emphasize such solid Westinghouse achievements as the nuclear engine for the Nautilus submarine and the 60,000 kw power station at Shippingport, Pa.

Upstairs, in the English section of the Exposition, I had a talk with Mr. John Ballinger, Supervisor of Atomic Power Construction for Taylor Woodrow, Ltd., civil engineers, contractors, and builders. Taylor Woodrow are the main contractors for Calder Hall,

CONSULTING ENGINEER



## END OF THE LINE

SCALE—layer upon layer of it—has reduced the inside diameter of this pipe to practically nothing. It's a common occurrence in some power plants, and the results are costly. The line must be taken out of service. That means production loss and expensive maintenance or replacement.

Scale, sludge, carry-over, and return-line corrosion are but a few of the problems that must be overcome to assure efficiency in boiler plant operation. In Dearborn's complete line of water conditioning

products, there is the correct treatment to eliminate every water trouble—the properly balanced treatment to reduce unnecessary maintenance, avoid shutdowns, and protect valuable equipment.

Since 1887, Dearborn products have provided trouble-free water to users of steam in all types of industry. That's why, today, power engineers in leading industrial plants throughout the nation look to Dearborn for consultation and assistance in solving their water treating problems.

### MAIL THE COUPON

Dearborn Chemical Company, Dept. CE  
Merchandise Mart Plaza, Chicago 54, Ill.  
Please send me complete information on Dearborn Water Conditioning.

Name.....Title.....  
Company.....  
Address.....  
City.....Zone.....State.....

# Dearborn®

...a leader in water conditioning  
and corrosion control

COMPACT SOURCE OF  
HIGH PRESSURE HOT AIR OR GAS

## THERMAL'S TYPE DF HEAT EXCHANGER

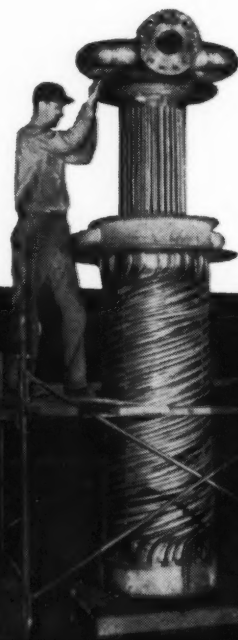
PRESSURES TO 300 PSIG  
TEMPERATURES TO 1200 F



Higher temperature units available

### Modernize your processing techniques...

Rapid heat-up and response characteristics make the THERMAL DF Heat Exchanger particularly valuable where wide load changes and operating levels must be met quickly. The minimum amount of refractory used makes convection heat transfer predominant.



### STRESS FREE DESIGN

Two pass counterflow construction is used with one pass being coiled to eliminate need for expansion joints. A THERMAL high velocity burner for gas, oil or combination is an integral part of the unit. Construction is all welded and of highest grade stainless steels.

WRITE FOR BULLETIN #105

OTHER THERMAL PRODUCTS & SERVICES ..... GAS & OIL BURNERS  
• COMBINATION GAS-OIL BURNERS • HEAT EXCHANGERS • AIR HEATERS  
• SUBMERGED COMBUSTION • COMBUSTION & HEAT TRANSFER ENGINEERING



# THERMAL

Thermal Research & Engineering Corp.

CONSHOHOCKEN • PENNSYLVANIA

REPRESENTATIVES IN PRINCIPAL CITIES

Britain's first atomic power station, which is now under construction and will be completed (tentatively) in 1957. Ballinger also tells me that Taylor Woodrow have just been awarded the preliminary contract to build an atomic power station at Annon, Scotland—also for the U.K. Atomic Energy Authority.

Here is how Ballinger sizes up the exhibits of the Americans and the English. He admits that the Americans have a more comprehensive experimental and development technology. However, the British exhibition is directed at the undertaking and production of a commercial project. He asks which American firms are ready right now to design and build a complete commercial power station. . . . "Not Westinghouse, GE, Bechtel, or any of the others," says Ballinger. "Taylor Woodrow, working with English Electric and Babcock & Wilcox, Ltd., is." His is a clear-cut if debatable point of view.

Visitors to the English exhibit get a three-sided sales pitch from each member of the group. Backed by excellent displays, top-level representatives, and the kind of challenging note . . . "where else can you get what we're offering you" . . . it is pretty powerful medicine. It will be interesting to see what kind of results these sales efforts will net.

A man who takes a more conservative outlook towards atomic power developments is Mr. Philip Sporn, President of the American Gas and Electric Co., who is in Geneva as an advisor for the U.S. Government. "Partly as a result of this Conference and Exposition," says Mr. Sporn, "too many countries are taking the attitude that atomic energy is the answer to all their problems. Most of them haven't given enough thought to such practical headaches as operation, maintenance, repair, and the establishments that must be set up to properly service an atomic power program."

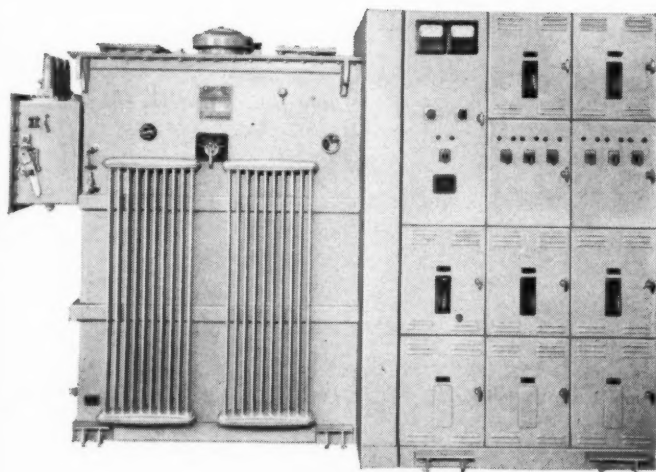
Sporn thinks the more conven-

CONSULTING ENGINEER



# SORGEL Substations are the best for Industrial, Commercial and Institutional Applications

SORGEL transformers are particularly adaptable for indoor installations; in hospitals, libraries, schools, institutions, office buildings, stores, and other structures where low noise levels are an important factor.



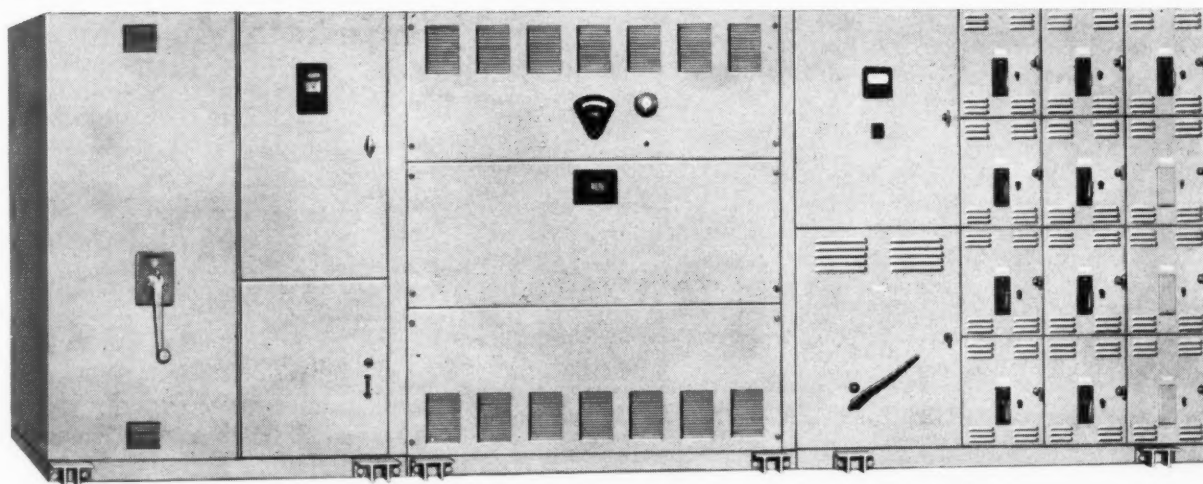
500 Kva, 13,800 volt Askarel-cooled SORGEL transformer, with primary liquid filled switch, secondary meters, and circuit breakers.

Because substations depend so much on transformers for continued, uninterrupted long service, SORGEL transformers are especially designed and constructed to meet the exact requirements of substation applications.

SORGEL transformers are not just ordinary transformers. They are especially designed and constructed to be installed indoors, close to load centers, thereby obtaining the most efficient distribution and better voltage regulation.

Without additional cost we make the substation fit the job, instead of expecting you to try to make the job fit the substation.

SORGEL transformers, 100 to 3000 Kva, all voltages up to 15 Kv, either dry-type or Askarel-cooled, to meet any requirements, can be furnished with any make or type of switchgear. And they are also procurable from any substation manufacturer.



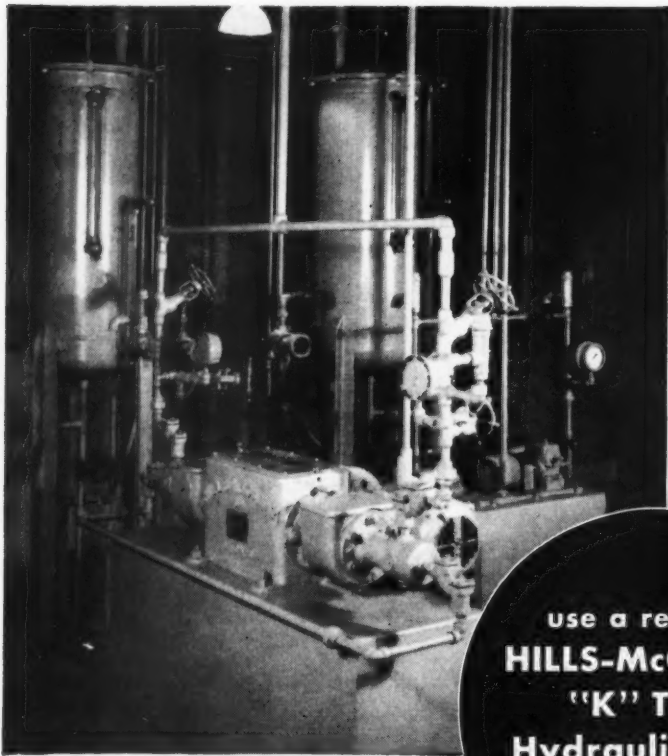
2000 Kva 3-phase, 13,200 volt air-cooled dry-type transformer, with primary switchgear, metering, and secondary breakers.

*Sales Engineers in Principal Cities*

**SORGEL ELECTRIC CO., 843 West National Ave., Milwaukee 4, Wis.**

*40 years' experience in the development, manufacturing and application of transformers*

## HERE'S HOW to take the headaches out of boiler feedwater treatment



*Two-feed Type "K-3" pump handling phosphate in internal boiler water treatment.*

use a reliable  
**HILLS-McCANN**  
"K" Type  
Hydraulic Drive  
Metering Pump

Dependability is essential in your boiler feedwater treatment set-up. And the heart of the set-up is the pump used to meter the treatment.

The Hills-McCanna "K" Type Pump offers standards of accuracy, dependability and freedom from maintenance never possible before. The "K" Type Pump utilizes a unique hydraulic drive in which the drive parts operate in an oil bath. Stroke is adjustable while the pump is in operation; control is accurate; automatic pressure relief is built in.

Ordinary pump problems such as exposed linkage . . . linkage lubrication . . . atmospheric conditions . . . vertical type liquid ends . . . linkage and drive misalignment are eliminated by the "K" pump's fully enclosed, in-line construction.

Hills-McCanna "K" Type Pumps are available in two styles, the "K-2" with  $\frac{3}{4}$  H.P. motor for maximum capacities from 2 to 135 gph per feed and the "K-3" with a 3 H.P. motor for maximum capacities from 1.6 to 730 gph per feed. The "K-2" develops pressures to 10,000 psi, the "K-3" to 30,000 psi. One and two feed units are available.

For further information ask for Bulletin KP-54 or send an outline of your requirements. HILLS-McCANN CO., 2446 W. Nelson St., Chicago 18, Illinois.

# HILLS-McCANN

*metering and proportioning pumps*

Also Manufacturers of:  
SAUNDERS TYPE DIAPHRAGM VALVES  
FORCE FEED LUBRICATORS • LIGHT ALLOY CASTINGS

tional methods of power generation which, after all, have been successfully proven, are often better suited for the available resources even when measured against the most optimistic hopes for atomic energy. Mr. Sporn told me he plans to inject this thought into the minutes of the proceedings. He also expressed the hope that American consulting engineers will help resist the emotional urge to jump at atomic power without first carefully considering existing power generating techniques and facilities.

I also had the opportunity to chat with Mr. Walker Cisler, President of the Detroit Edison Co., at his hotel. Mr. Cisler is also an official adviser to the U.S. Government. He is interested in all the activities and proceedings both at the Conference and at the Exposition. It should be mentioned, too, that Mr. Cisler is President of Atomic Power Development Associates, Inc. as well as President of the Fund of Peaceful Atomic Development. This gives him a broad platform from which to evaluate the work in Geneva.

Mr. Cisler agrees that there is nothing especially new in the way of technical knowledge being presented here. But then, as he points out, the purpose of the Conference must be seen in the light of its human aspects. The exchange of knowledge is only as fruitful as the willingness of the various representatives to cooperate. Seen from this viewpoint, the Conference is a complete success. Enthusiastic cooperation, genuine friendliness, complete absence of politics, and the urgent desire of all to exchange information and to work for the peaceful utilization of atomic energy are the intangibles that Mr. Cisler refers to in calling the meeting successful.

However, there are major deficiencies in the program. The economic aspects of atomic power have been relegated a secondary position. As a good businessman, Mr. Cisler cannot overlook this point, although scientists and

**In Growing Florida's Largest Power Plant...**

# **CADWELD CONNECTIONS PLAY A VITAL ROLE!**

Florida's really growing places! In population gains, in light industry growth—the Sunshine State is among the nation's leaders.

To meet this tremendous power demand Florida Power and Light Company—largest power supplier in the state—spent a record \$41,700,000 in 1954 alone, a total of \$250,000,000 since V-J Day.

In power plants such as Cutler near Miami, which by midsummer 1955 will have 380,000 kilowatts capacity, and in substations throughout the state CADWELD connections help FP&L speed its gigantic \$410,000,000 construction program.

For in fabulous Florida—where industry finds a business climate as favorable as the natural climate—power engineers have found CADWELD connections are best because:

- 1—They do not require mechanical pressure for contact.
- 2—They cannot loosen or corrode.
- 3—They have greater current carry-

ing capacity—this keeps connections operating cooler than the cable.

- 4—They are compact—thus simplifying reinsulation.

CADWELDED . . . this #2/0 stranded copper cable ground wire to 69 KV steel structure.

Compact, trouble-free CADWELD connections—more than 4500 of them—are used in FP&L's Cutler plant switchyard shown below.



## **CADWELD®**

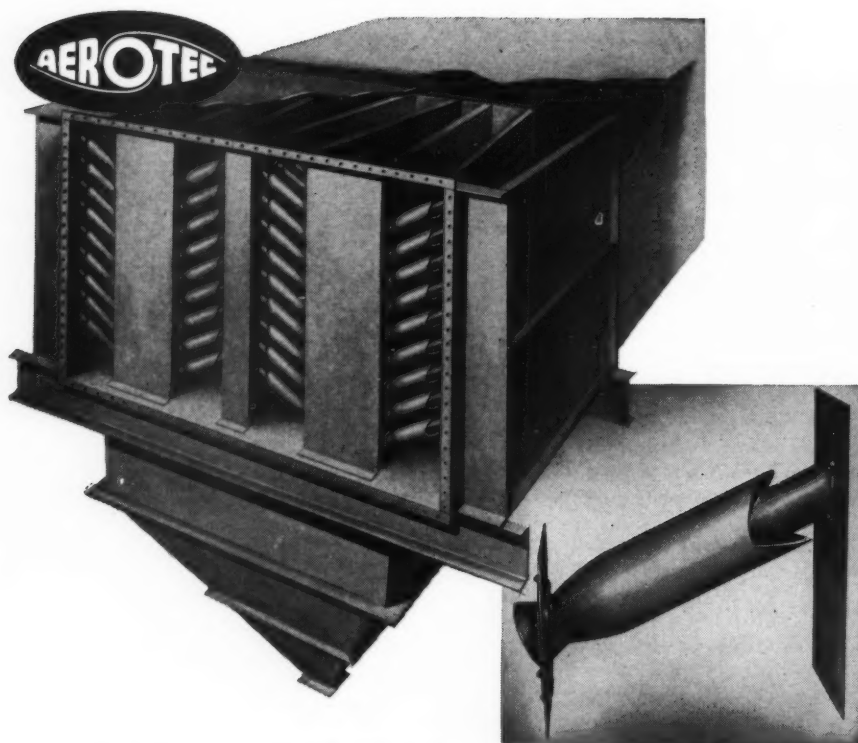
**Erico Products, Inc.**

2070 E. 61st Place

Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario





*longer life for*

## MECHANICAL DUST COLLECTORS

### New Aerotec Tube Offers

- Higher Efficiency
- Erosion Resistance
- Simplified Field Erection
- Low Maintenance

The new Aerotec 5" Tube of white cast iron assures extremely high dust collector efficiency and in service far exceeds tubes of other basic metals. Accelerated tests conducted by Aerotec engineers have proven conclusively that white iron is superior in reducing wear, even when caused by the most highly abrasive particles.

Tubes are factory assembled into "building block" elements to simplify field erection. In addition, the inherent design of the 5" Tube reduces the possibility of plugging, even at low temperatures, or when the fuel has a high sulphur content. Years of research behind the development of this tube now assure a collector that requires minimum maintenance.

For information about the new Aerotec Tube, call or write to The Thermix Corporation, Project Engineers for Aerotec.

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.

(Offices in 38 principal cities)

Canadian Affiliates: T. C. CHOWN, LTD, 1440 S. Catherine St. W., Montreal, Que.

Manufacturers

**THE AEROTEC CORPORATION**

Greenwich, Conn.

technicians are often inclined to brush it aside. The fact that almost all of the papers presented at the Conference came from scientists and government representatives makes it a slightly one-sided presentation. It is important that commercial and industrial aspects be given consideration. There is a degree of danger in proceeding until commercial knowledge gives us a better yardstick.

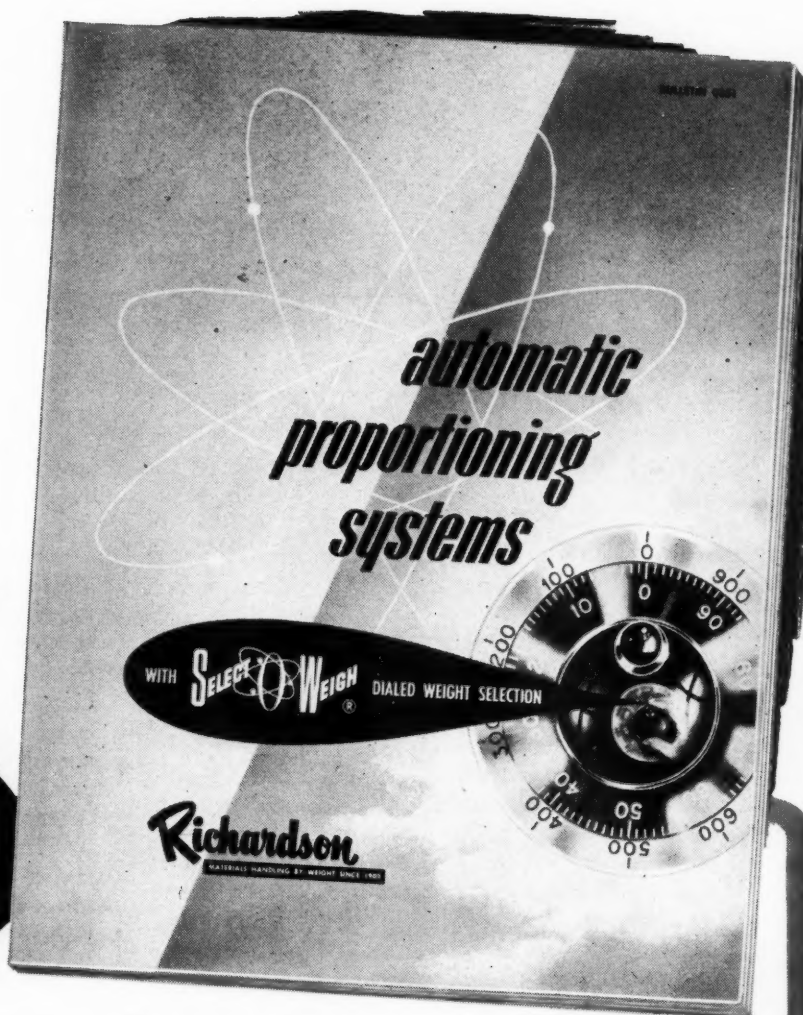
As for the Exposition, Mr. Cisler spotted a lack of exhibits to give an adequate picture of the thermal side of atomic power applications. The English exhibit might be summarized as conventional equipment with a nuclear slant. Our own American exhibition was not as fully representative as it could have been—probably because of the short notice and lack of time to prepare an adequate exhibit—and it would be a mistake to judge America's nuclear know-how and capacities by what was shown here.

The results of this Conference and Exposition will be seen in the broader interchange of information on an international basis. The desire for peaceful application of the atom may manifest itself in less emphasis on bombs and military uses and more in the fields of nuclear energy for power generation, medicine, agriculture, and industry. Too rapid a development of atomic power is probably not warranted until we have more concise information on the economics, operation, and other commercial considerations, concludes Mr. Cisler. And let's take the enthusiasm of our international friends in their projected programs of atomic power developments with a grain of salt. After all, it takes a lot of money to dabble with atomics, and the people who are going to finance these projects will insist on a reasonable element of risk as well as a return on their investments. In a few words, this means more time and experience will offer a much sounder foundation for evaluation of the atomic energy field. ▲▲

CONSULTING ENGINEER

**REMOTE  
DIALED WEIGHT  
SELECTION BELONGS  
IN YOUR BUSINESS**

**THIS NEW FREE BOOK  
TELLS THE FULL STORY  
OF**



# **RICHARDSON SELECT-O-WEIGH®**

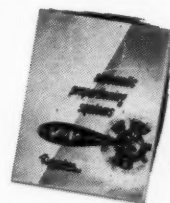
## **REMOTE WEIGHT SETTING SYSTEMS**

Here are answers to the puzzlers you've had about completely automatic weighing, proportioning and blending. Richardson's new 28-page booklet shows in detail how industries like yours use Select-O-Weigh systems to "dial" as many as 20 individual ingredient weights in formulas.

Many industrial "case histories" and over fifty easy-to-understand diagrams and illustrations take you through Richardson's material-saving, time-saving, labor-saving story of finger-tip formulation which requires no manual changes, even

for fractional proportions. Send for this free booklet today. See how a Select-O-Weigh system—developed out of Richardson's 50 years of experience in building automatic weighing, proportioning and blending equipment—can solve countless problems in your change-over from conventional weighing and proportioning methods to automation.

**Write today for your free copy of Bulletin 0351.**

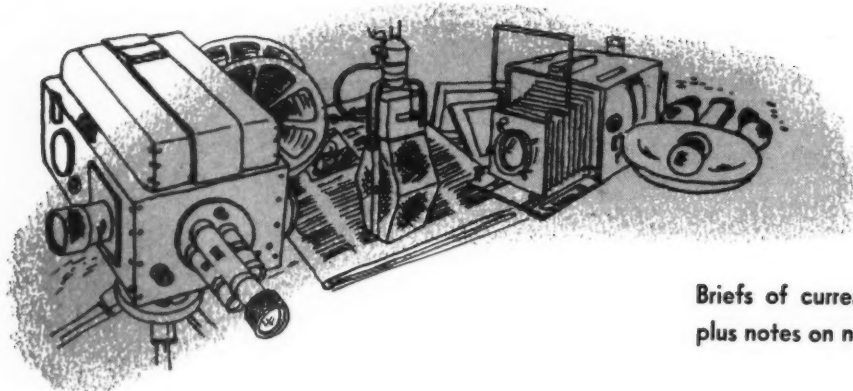


# **Richardson**

**MATERIALS HANDLING BY WEIGHT SINCE 1902**

### **RICHARDSON SCALE COMPANY Clifton, New Jersey**

Atlanta • Boston • Buffalo • Chicago • Cincinnati • Detroit  
Houston • Memphis • Minneapolis • New York • Omaha  
Philadelphia • Pittsburgh • San Francisco • Wichita • Montreal  
Toronto • Havana • Mexico City • San Juan



## NEWS

Briefs of current interest to the consulting profession plus notes on new equipment in the field of engineering

### Bituminous Coating Prevents Corrosion of Steel Piling

Corrosion hazards are sometimes unintentionally incorporated in the design of steel piling foundations, according to David Hendrickson, Senior Engineer, The Hinchman Corp. When the upper portion is encased in concrete and remainder of the steel pile is in contact with the soil and water, the combination creates a galvanic couple causing a galvanic current to discharge adjacent to the concrete, as shown in the drawing. Heavy corrosion will take place at the point of current discharge.

The phenomenon involved in this type of corrosion is electro-chemical and is caused by creating dissimilar electrolytes. The portion of the steel pile that is encased in concrete is cathodic to the bare steel, causing corrosion to occur on the bare portion near the concrete.

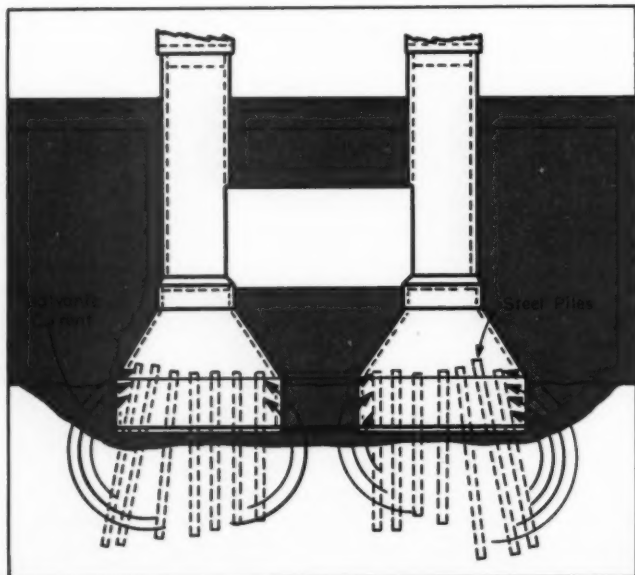
The simplest method of avoiding creation of a galvanic couple is to insulate the portion of the steel pile that is encased in concrete. This can be accomplished by using a heavy bituminous coating (such as is used on pipe lines) on this portion of

the piling. If the cathodic area can be eliminated from the picture, corrosion can be controlled. Cathodic protection also can be used to prevent this type of corrosion, but high current density should be avoided since it weakens bond between concrete and steel.

However, using a bituminous coating on the portion of the steel piling that is encased in concrete destroys the bond between the concrete and steel. Therefore, it is necessary to design the piling to take the load without steel-to-concrete bond.

In corrosion surveys some engineers use the potential of the structure to soil as a criterion. When part or all of a structure is encased in concrete the potential to soil is changed by several hundred millivolts. Special technique must be used in determining the status of cathodic protection.

Steel will corrode at the rate of 20 pounds per ampere per year. If the current density is high at the point of discharge considerable metal will corrode. Galvanic currents as high as 80 amperes have been observed on pipe lines.



ARROWS SHOW DIRECTION OF CURRENT DISCHARGE.

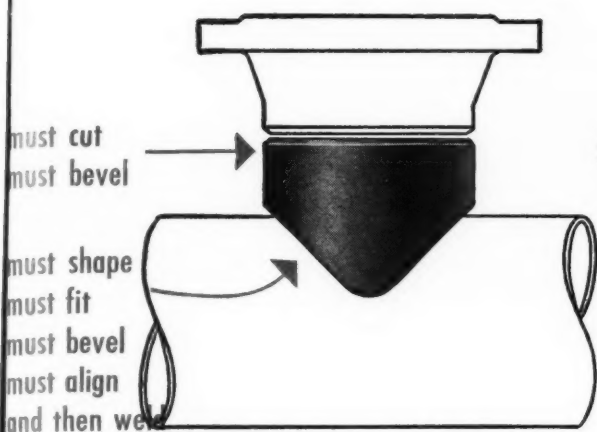
### TVA Proposes To Do Consulting Work

The Senate Public Works Subcommittee on Flood Control—Rivers and Harbors has before it S. 2373, "To amend the Tennessee Valley Authority Act of 1933. . . ." Section 15d (g) is of considerable concern to consulting engineers. It reads:

"In connection with the construction of a generating plant or other facilities under an agreement providing for lease or purchase of said facilities or any interest therein by or on behalf of the Corporation, or for the purchase of output thereof . . . [to] perform engineering and construction work and other services, and may enter into any necessary contractual arrangements."

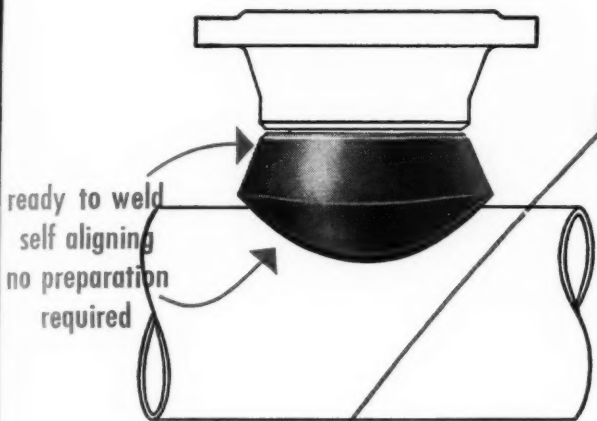
The National Society of Professional Engineers wrote to Senator Robert S. Kerr, chairman of the subcommittee, to the effect that NSPE was strongly opposed to this attempt of TVA to enter consulting engineering practice as set forth in the bill. NSPE pointed out that such a grant of authority would be "unwarranted interference with the normal functions and operations of private consulting engineers who have been and are available for





**short nozzles**

**don't pay...**



**Bonney Weldolets**  
**do!**

Even on low pressure piping... avoid non-productive preparation time...

**SPECIFY and USE WELDOLETS**

No joint preparation is required for either weld of the Weldolet, whereas considerable preparation is required for both welds of the miter branch construction.

The integral reinforcement of the Weldolet Welding Fitting has established it as an ideal method of constructing branch connections on high pressure and/or high temperature piping. This feature is *bonus insurance* on low pressure piping where the Weldolet is easier and more economical to use than preparing the two ends of a short unreinforced nozzle.



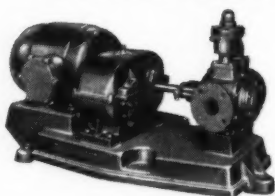
WELDING FITTINGS DIVISION

**FORGE & TOOL WORKS**

370 GREEN ST., ALLENTOWN, PENNA.

## "NEW PUMP" PERFORMANCE

*after years  
of service*



## with BLACKMER rotary pumps

Here's how you can restore "new pump" efficiency at a fraction of the cost of a new pump, thanks to Blackmer engineering and design.

**REPLACEABLE LINER** It takes only a matter of minutes to replace the liner of a Blackmer Pump after excessive wear has been caused by the handling of corrosive or abrasive materials.

**REPLACEABLE VANES** The vanes in Blackmer Rotary Pumps are self-adjusting for wear and give sustained efficiency over years of service. In case of extreme wear or damage, they can be replaced quickly, using only simple hand tools.

Blackmer Rotary Pumps are handling hundreds of liquids and semi-solids successfully.



liquid materials handling®

# BLACKMER

Industrial, Hand and Truck Pumps, Strainers, Pressure Control Valves  
**BLACKMER PUMP COMPANY, GRAND RAPIDS 9, MICH.**  
DIVISION SALES OFFICES — NEW YORK • ATLANTA • CHICAGO  
GRAND RAPIDS • DALLAS • WASHINGTON • SAN FRANCISCO  
*See Yellow pages for your local sales representative*



such normal professional activities." The letter also stated that this authority would conflict with state engineering registration laws in that TVA, as a government corporation, is not licensed under any of the state laws to offer and perform professional engineering services for others.

G. O. Wessenauer, Manager of Power for TVA, at a public hearing before the subcommittee, contended that TVA should be authorized to provide engineering and construction services where a municipal agency or REA co-op might be able to finance a plant that is to become part of the TVA power system but might not be able to design and build it. After the NSPE letter was read, Wessenauer noted that he was speaking of plants that would become part of the TVA system under lease-purchase arrangements. A member of the subcommittee pointed out that under the bill the engineering services are not limited to facilities that TVA expects to acquire but also include services to plants whose output TVA might purchase.

## Cities Work to Provide Off-Street Parking

The need for off-street parking space in large cities is obvious—but the solution to the problem is usually difficult. City and state laws and regulations vary widely as to means of financing and ownership—voter attitude must be taken into account.

Two controversial off-street parking ordinances are pending before the Indianapolis City Plan Commission. One would require all new commercial building outside the city's Mile Square to provide three square feet of parking space for every square foot of rental space. The other ordinance would require apartment builders to furnish a parking space for each family instead of the present ratio of one space for three families. The Indianapolis Off-Street Parking Commission has approved preliminary plans and specifications for the city's first municipally-owned garage, which may also be used as a heliport. Buildings on the site would be razed to make way for the project, but construction is held up pending ruling by the State Supreme Court on a suit challenging the Commission's powers.

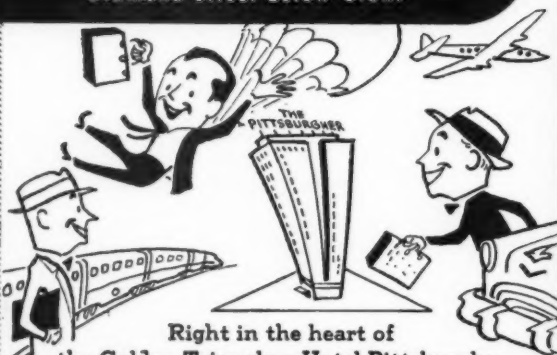
In Maryland, a group of businessmen has asked the Baltimore Off-Street Parking Commission to use its power of condemnation to open up parking space in a neighborhood shopping district. The group had purchased seven pieces of property on the proposed site, but four of the eleven property owners refused to sell.

In Milwaukee, Wisconsin, the City Land and Parking Commissions "tossed the ball" to the Land Commission's planning staff, asking them to study the problem and make recommendations by October 1. Parking Commission Chairman Edward R. Prince summed up the attitude as to downtown parking facilities, "There is a running argument on whether structures should be built and whether more parking should be provided by the demolition of blighted buildings."

## Handiest Locations in PITTSBURGH

*Hotel Pittsburgher*  
PITTSBURGH, PA.

Diamond Street below Grant



Right in the heart of  
the Golden Triangle—Hotel Pittsburgher

400 outside rooms with bath. Large-screen television and radio at no extra charge in every room. Air conditioning. Two restaurants. *ATLantic 1-6970*

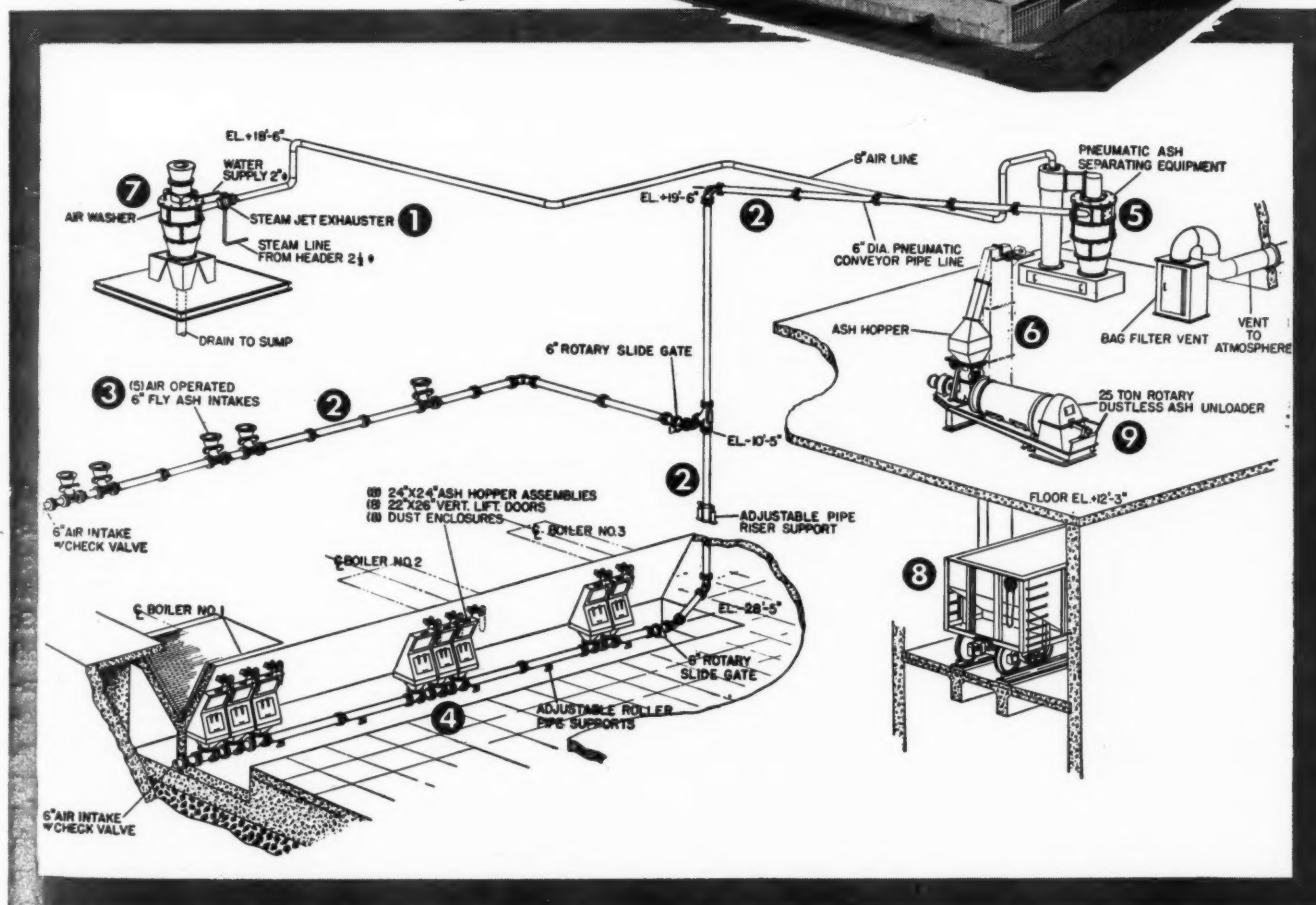
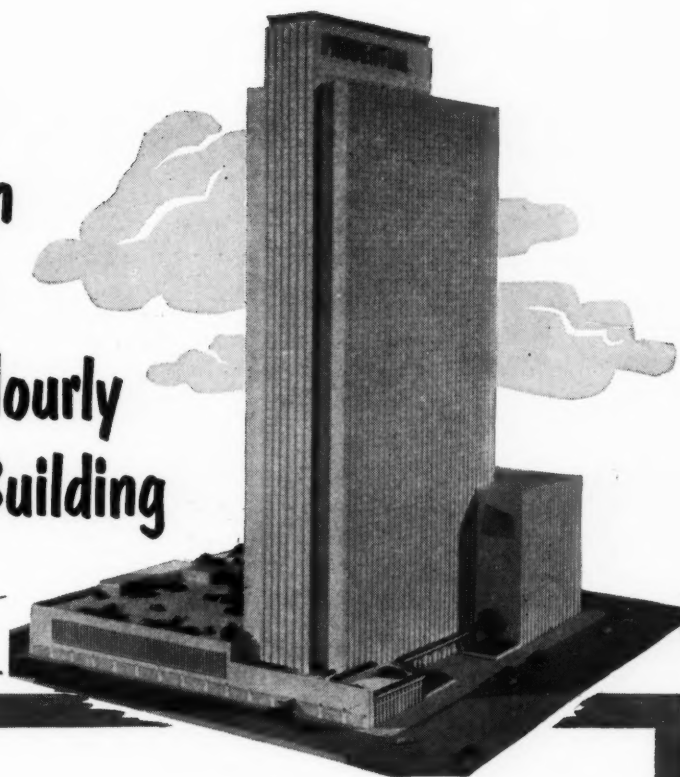
### Hotel Pittsburgher MOTEL

Opposite Greater Pittsburgh Airport on Airport Parkway west. 56 air-conditioned rooms with large-screen television at no extra charge, tile bath, private phone. Courtesy car to and from motel.  
*AMherst 4-5152*

*a Knott Hotel*

JOSEPH F. DUDDY, GEN. MGR.

# One Touch of This Button Will Remove 10 Tons of Ash Hourly at New Prudential Building



One of the many efficiency features of the new Prudential Building in Chicago is another Pettibone-engineered, labor-saving Ash Handling System, designed entirely from standard Pettibone ash handling equipment.

Only one operator is needed! One touch of a button sets this chain reaction into motion: Steam is induced into the Steam Exhauster (1). The vacuum created pulls air at high velocity through the Ash Line (2). The operator opens selected Fly Ash Intakes (3) or Ash Gates (4). The ash is then sucked to the Ash Separator (5) at the rate of 10 tons/hr., where the fines are removed, thence gravitated to the Ash Storage Bin (6). The air and steam continue to the Air Washer (7), where the fines are washed out and the steam condensed. When convenient, the ash is discharged from the storage

bin (6) into rail cars (8) at the rate of 25 tons/hr., conditioned with water via the Dustless Ash Unloader (9).

This same efficient ash removal system can be engineered for both large and small installations, separately from or in conjunction with Pettibone coal handling systems and stokers. Ask for details.

**PETTIBONE MULLIKEN CORP.**

4700 West Division Street  
Chicago 51, Illinois • SPaulding 2-9300





# REPORT FROM BRITAIN

. . . perhaps it's time we met.

**FRITZ HIRSCHFELD**  
European Editor



Beerbohm

THE ORGANIZATION for European Economic Co-operation (O.E.E.C.) has suggested sending a team of European consulting engineers to the U.S. to study American consulting practices. The idea has merit and, if properly carried through, could lead to enlightening experiences for both groups.

## Is This an O.E.E.C. Job

However, as I sat in the London office of Julian Tritton (partner in the consulting firm of Rendel, Palmer and Tritton) and discussed this proposal, I could not help wondering why the initiative in bringing together European and American consulting engineers had fallen to the O.E.E.C. Are we so standoffish or are the Europeans so hard to talk to that we cannot arrange our own introductions?

The O.E.E.C. is an agency created and supported by the governments of Europe and the U.S. to help European nations increase their economic well-being. It concerns itself with such problems as efficient methods of production and industrial and financial management. While the O.E.E.C. has done excellent work in its field, it is neither well-enough acquainted with American consulting engineers nor well enough known by them to be able to arrange the best and most effective contacts.

That puts the problem right where it belongs. It should be the consultants' responsibility to invite the spokesmen for European consulting engineers to the States. A personal invitation will give both parties an opportunity to talk freely and on intimate terms. At luncheons or small, private get-togethers, questions ranging from liability laws to the prospects of building a bridge in Northern Rhodesia could be pursued in off-the-record discussions.

## Why Take the Initiative

There are a number of good reasons why we should seriously consider taking the initiative in establishing friendly firsthand contact with European consultants. Most of them have had long and varied experiences in the organization of consulting engineer associations; membership requirements; formulating and enforcing codes of ethics; scheduling fees; introduction of liability laws; and other

ideas that would certainly be stimulating—and perhaps directly applicable—to professional consulting engineers in the U.S.

European consulting engineers, especially the British, have spent many years working on projects in foreign countries. They have gathered a great deal of information on operating conditions, peculiarities of the regions, potential projects, and other data, all of which could be of value to American firms engaged in or contemplating foreign work.

The British Association of Consulting Engineers dates back to 1908, to the time when the British Empire was intact and British commerce and finance were dominant. British consultants were active in all sections of the Empire with a variety of development schemes financed by British capital and linked with the British government or industry. In those days they had no competition, and it was a golden opportunity to establish themselves firmly during the growth and expansion of those countries.

## A Swing to U. S.

Two World Wars and a host of political, social, and economic circumstances have changed the picture. The financial and commercial center of gravity has swung to the U.S. Today it is U.S. capital that is financing much of the world development and U.S. industry that is providing the necessary goods and services. And the British Empire is now the Commonwealth, with the Commonwealth countries largely free to trade and open their doors as they choose.

Nevertheless, British influence is still very strong in the Commonwealth and those countries formerly under British rule. The fact that a number of British consultants maintain offices in the major cities of the Commonwealth countries is another strong tie. English consulting engineers are active designing dams, highways, railways, bridges, water supplies, and community housing projects from Egypt to South Africa and Burma to Australia.

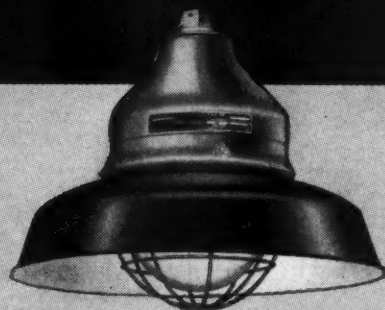
These countries are just beginning to come into their own. Their natural resources have hardly been touched, and they are virgin markets for every type of product and service. No one is suggesting that the British are going to welcome the competition of

the **S**witch is to **PYLE-NATIONAL**

## industrial lighting fixtures

### EXPLOSION-PROOF

LE Series (Class I, Groups C and D)  
60 to 500 Watts  
Choice of body and reflector styles



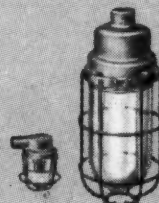
### DUST-TIGHT

DE Series (Class II, Groups E, F and G and Class III)  
60 to 200 Watts  
Choice of body and reflector styles



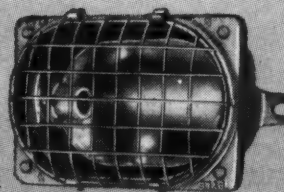
### VAPOR-TIGHT

DO Series 10 watt signal  
or pilot lights  
BO Series 50 to 500 watts  
Choice of body and reflector styles



### FLUSH VAPOR-TIGHT

Type 1570 Pit and subway lights  
100 and 200 watts



Literature Furnished On Request



Sold Nationally Through Authorized Distributors

**THE PYLE-NATIONAL COMPANY**

WHERE QUALITY IS TRADITIONAL

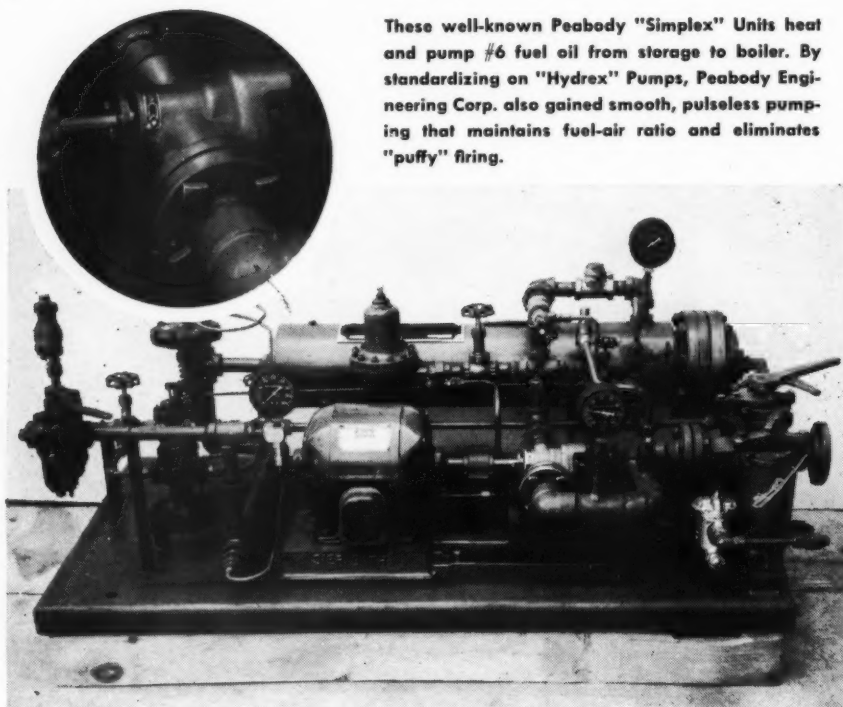
1337 N. Kostner Avenue, Chicago 51, Illinois

District Office and Representatives in Principal Cities of the United States. Export Department: International Railway Supply Co.,  
30 Church St., New York. Canadian Agent: The Holden Co., Ltd., Montreal, Toronto, Winnipeg, Vancouver.

CONDUIT FITTINGS • PLUGS AND RECEPTACLES • TURBO-GENERATORS • MULTI-VENT AIR DISTRIBUTION

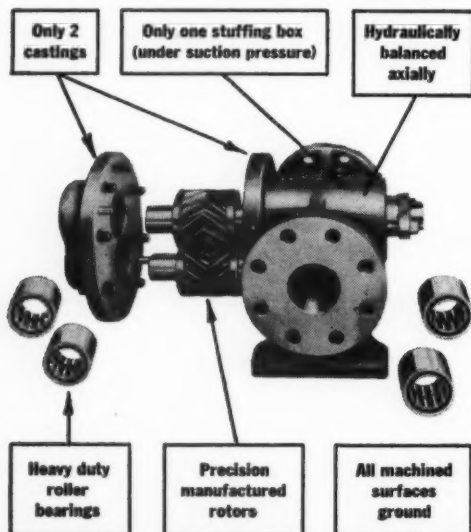


Simplicity, compactness and dependability of  
**Sier-Bath HYDREX® Pumps**  
 prove ideal for PEABODY "SIMPLEX" PUMP AND HEATER SETS



These well-known Peabody "Simplex" Units heat and pump #6 fuel oil from storage to boiler. By standardizing on "Hydrex" Pumps, Peabody Engineering Corp. also gained smooth, pulseless pumping that maintains fuel-air ratio and eliminates "puffy" firing.

**Sier-Bath HYDREX PUMP**

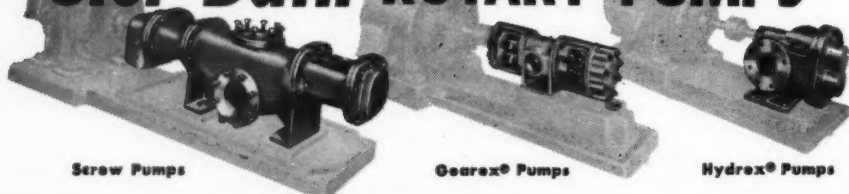


The simplest heavy duty gear pump made! Use it in place of pumps costing much more . . . for handling chemical solutions, fuel oils, lube oils, hydraulic liquids, etc.

The "Hydrex" needs no costly speed reducer—can be direct-connected up to 1800 RPM. Extreme simplicity allows heavier construction, easier installation and maintenance, less downtime, longer life.

Models available to pump liquids from 32 SSU to 250,000 SSU, at 1 to 350 GPM, up to 500 PSI. Call your local Sier-Bath Pump Representative . . . write to Sier-Bath Gear & Pump Co., Inc., 9257 Hudson Blvd., North Bergen, N. J.

**Sier-Bath ROTARY PUMPS**



50th Anniversary

Mfrs. of Precision Gears, Rotary Pumps, Flexible Gear Couplings

Member A.G.M.A.

American consulting engineers in these areas with open arms. On the other hand, the British are not blind to the economic facts of life. Americans have the private capital and strength to underwrite projects in Africa and Asia. They also have specialized knowledge and experience in certain fields which would be useful in this development work. There is reason to believe that in many areas co-operation between American and British consulting engineers would be of mutual benefit.

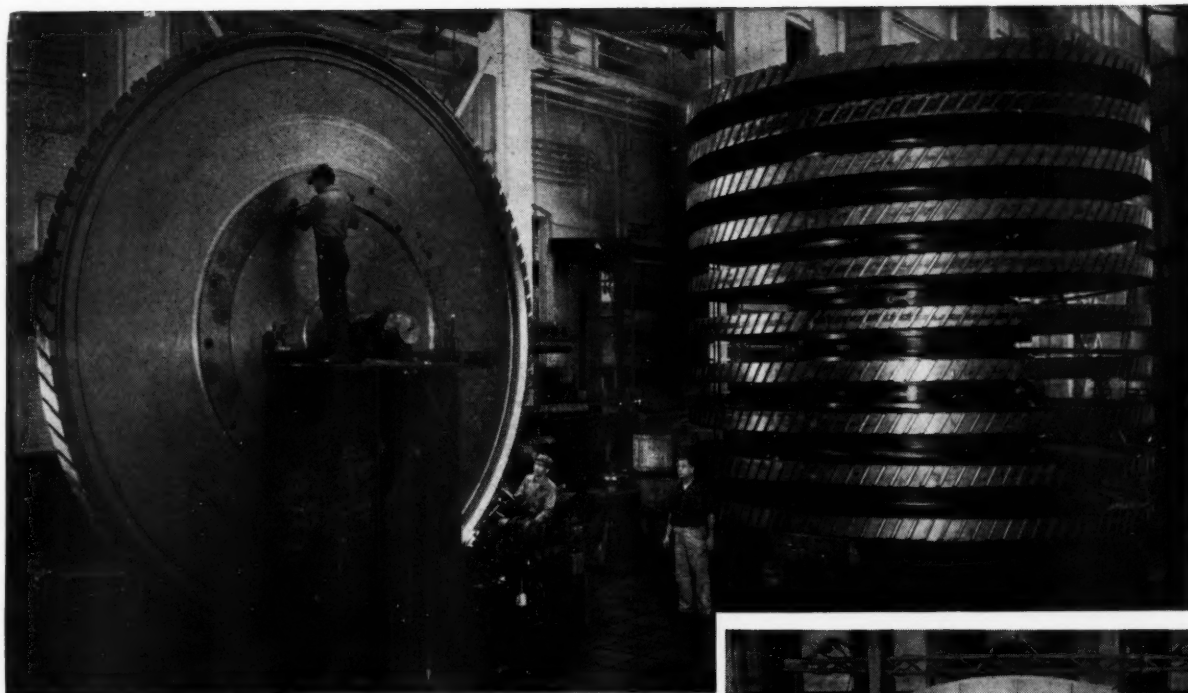
**New President of Federation**

One English consulting engineer who is internationally-minded and who is well aware of the possibilities of cooperating with Americans is Julian Tritton. According to *The [British] Consulting Engineers Who's Who and Yearbook*, for 1955, Tritton is the partner in charge of his firm's railway and marine department. Born in Calcutta, educated in England, Tritton has had extensive consulting experience in many parts of the world. He is also familiar with the States. During the war he was Technical Advisor to the India Supply Mission in Washington, for locomotives and rolling stock. Aside from his technical work, he is a past Chairman of the Association of (British) Consulting Engineers and was recently elected President of the International Federation of Consulting Engineers.

In spite of his broad background and the fact that there is no language barrier between England and the U.S., I was amazed at Mr. Tritton's seemingly complete unfamiliarity with the functions and organizations of our American consulting engineers. The work of the National Society of Professional Engineers, the growth of our State Associations of Consulting Engineers, our Engineering Codes of Ethics, Engineer's Joint Council, the American Institute of Consulting Engineers, and other phases of consulting and engineering society activities

CONSULTING ENGINEER





Rotor discs for mammoth 11-stage compressor were balanced and stacked for alignment in one of Newport News' five huge machine shops. Large engineering and technical staffs with a vast plant make Newport News an ideal source for large equipment . . . standard or special in design.

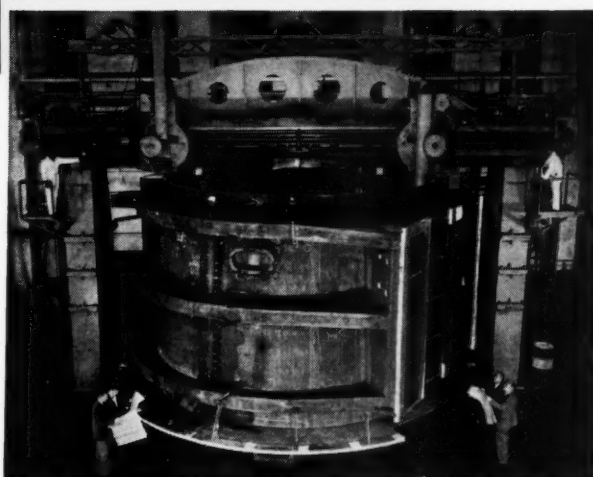
## To create winds exceeding **2000 MPH** Newport News builds world's Mightiest Compressor

Whenever you want large units built with careful attention to detail, give the job to Newport News.

This company recently built an eleven-stage axial flow compressor that shatters all previous records for wind force . . . using what is believed to be the world's largest rotating object.

The rotor, weighing more than 400 tons, comprises eleven huge discs. Each disc, machined from a 96,000-pound forging, was finished to a 50,000-pound wheel and balanced to within 26 ounces at the rim. In each rim, slots for blades were machined to within .005" on special milling heads designed and produced in the Newport News plant.

Here at Newport News, you'll find more than large productive capacity. In machine shops, foundries and forging plants Newport News craftsmen complete your orders with specialized techniques backed by experience in fabricating thousands of products.



A 35-foot boring mill in Newport News' plant machining the 374,000-pound upstream housing for the giant axial flow compressor. The compressor is heart of an 8-foot supersonic wind tunnel at the Ames Aeronautical Laboratory of the National Advisory Committee for Aeronautics at Moffett Field, Calif.

Newport News' craftsmen produce units that range from small components of spinning machines, to mammoth hydraulic turbines . . . from piping, pumps and valves, to vacuum tanks, digesters and bridge caissons.

These skilled men handle the job exactly as you want it done, for maximum results per dollar invested. So let us bid on your present or future projects. Learn how Newport News can help you. Send for our illustrated booklet entitled, "Facilities and products" . . . it's your for the asking.

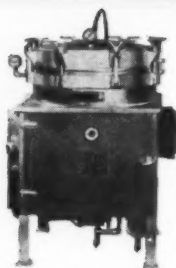
## Newport News

**Shipbuilding and  
Dry Dock Company**

Newport News, Virginia

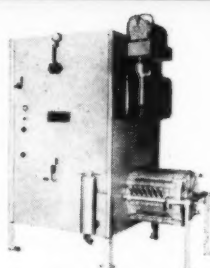
# HILCO LUBRICATING and INDUSTRIAL Oil Maintenance Equipment

*Saves Your Oil, Money and Machinery*



**OIL RECLAIMER**

For continuous oil purification in range of 2-100 gph. Removes all solids, acids and volatile contaminants.



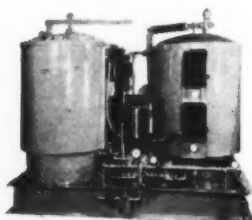
**PURIFIER-RE-REFINER**

For all purification in batches of from 6 to 100 gallons. Removes all solids, acids and volatile contaminants.



**FILTER**

Furnished in capacities from 0.1 to 750 gpm. Various cartridges available for mineral and inhibited detergent oils.



**HIGH CAPACITY RECLAIMER**

Combines filtration for removal of solids and sludge with vacuum vaporization for removal of solids, acids, water, solvents, fuel dilution. Furnished in standard or custom built models to 600 gph.

HILCO purification means *complete* oil purification . . .

Whenever oil is used it becomes contaminated and must be discarded or conditioned for further use. There is a HILCO to do this job for you. You can recover large quantities of oil at low cost. HILCO units are available for continuous or batch operation.

A COMPLETE LINE OF  
EQUIPMENT FOR RE-  
CLAIMING, FILTERING,  
PURIFYING AND RE-  
REFINING OIL FROM . . .

- Diesel Engines
- Trucks
- Tractors
- Gasoline Engines
- Gas Engines
- Automobiles
- Buses
- Heat Treating Systems
- Locomotives
- Steam Turbines
- Steam Engines
- Air Compressors
- Vacuum Pumps
- Transformers
- Circuit Breakers
- Wire Drawing Machines
- Hydraulic Equipment
- Metal Rolling Mills
- Paper Making Machinery

THERE'S A HILCO TO DO THIS JOB FOR YOU

• **CONSULTING ENGINEERS** •

**WRITE TODAY!** FOR THE NEW HILCO  
CATALOG FOR COMPLETE INFORMATION  
AT NO OBLIGATION . . .

**THE HILLIARD Corporation**

1001 W. FOURTH STREET

• ELMIRA, NEW YORK

IN CANADA: Upton-Bradeen-James Ltd., 890 Yonge St., Toronto; 3464 Park Ave., Montreal



in America are virtually unknown, not only to Mr. Tritton, but to most European consultants.

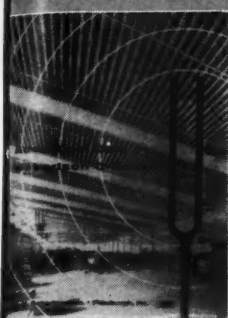
## No Point of Contact

The fundamental trouble is that there is no point of contact for American and European consulting engineers. Even though there is strong interest and curiosity on the part of the Europeans, they have no opportunity to talk with private American consultants nor do they generally have access to the published literature in the States that concerns itself with the American consulting engineer. Yet these barriers could be easily removed and the groundwork laid for a much freer exchange of information and possible cooperation in professional activities.

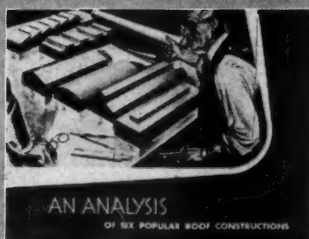
Here are some proposals that I believe would help create a point of contact for the European and the American consultants:

As an initial step, an invitation might be extended to Julian Tritton, in his capacity as President of the International Federation of Consulting Engineers, to visit with some American consulting engineers and to be introduced by them to other American consultants in different parts of the country. In the give-and-take of private discussion, Mr. Tritton could ask and answer questions. He could convey to American consulting engineers an accurate and comprehensive picture of the consulting practices not only in Great Britain but in the other European countries as well. And just as important, he could take home his impressions and a realistic concept of the activities of the U.S. consulting engineer.

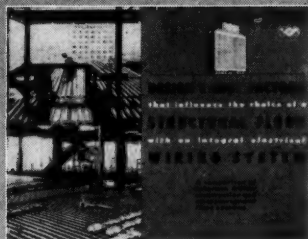
A good number of American consultants should visit Europe each year. A convenient invitation could be arranged for them to meet with local groups of consulting engineers in Europe. Languages might be a handicap although English would suffice for Scandinavia, Holland, and Switzerland. If a German-speaking American consulting engineer



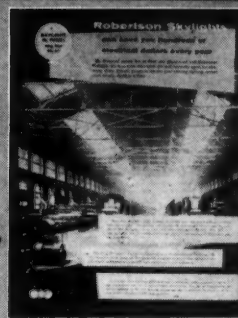
2



3



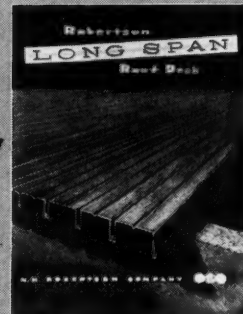
4



6



7



8



# Write-

## for these free books

### from Robertson's technical library

**1. Acoustical Data on Q-Deck:** It has long been known that the fluted underside of steel deck provides some acoustical value, yet demand for more has led to this new low-cost method. Application details and test data are included.

**2. An Analysis of Industrial Roof Construction:** This valuable booklet compares all the better-known roof types (flat, monitor, bow-string, high-low bay, saw tooth) on the basis of structural steel, volume, roofing, sash area, flashing, ventilation and daylighting.

**3. Design and Cost Factors of Structural Floor Wiring:** This study compares Q-Floor with other conventional floor systems using underfloor duct. Based upon a typical multi-story building, the book is replete with charts and cost analyses of all structural components.

**4. Daylighting Cost Analysis:** This new and unusual study contains a questionnaire, which when properly filled out will reveal how quickly scientifically planned natural daylighting will pay for itself in a structure through savings in electricity. All data are substantiated.

**5. New Composite Q-Floor Catalog:** This newly revised catalog contains many examples of the latest Q-Floor buildings and a full exposition of Q-Floor advantages. Structural details and specifications are more complete than ever before.

**6. New M-Type Q-Panel Catalog:** Recent newcomer to the Robertson product family is the M-Type Q-Panel which possesses unique advantages over other types of modern curtain wall construction. The book contains 3 pages of structural details plus complete specifications.

**7. New Long-Span Q-Deck Catalog:** Another new Robertson product is this sturdy, yet exceptionally long-span deck. Easy to handle and erect despite its length up to 32 feet, it is especially designed for schools and supermarkets and other structures in which unbroken spans and a saving of structural steel is beneficial.

**8. Ventilation Engineering Booklet:** More than a ventilator catalog, this booklet not only describes products, but contains detailed tables of exhaust capacities, based upon average wind velocities, temperature differences and height above intake. Use the coupon below.

# Robertson Products

## for modern buildings

**H. H. Robertson Company**

2431 Farmers Bank Building, Pittsburgh 22, Pa.

In England: Robertson Thain Ltd., Ellesmere Port, Cheshire

In Canada: Robertson-Irwin Ltd., Hamilton, Ontario

Offices in Principal Cities



Please send the free data book(s) I have circled below.

1      2      3      4      5      6      7      8

NAME \_\_\_\_\_

FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_



# more and more

engineers of leading  
industries are specifying



250 KVA, Oil Immersed, Self-Cooled  
Distribution Transformer, Type LS.

Marcus Transformers installed for lighting distribution in new Ford plants near San Jose, California, Louisville, Kentucky, and Mahwah, New Jersey as part of the Ford Motor Company's huge coast-to-coast multimillion dollar expansion program.

#### Architects

Albert Kahn Associates      Giffels & Vallet  
and L. Rossetti

#### Electrical Contractors

Fischbach and Moore, Inc.—San Jose, Calif.  
Hatfield Electric Company—Louisville, Ky.  
A. Neri, Inc.—Mahwah, New Jersey

"Mark of Quality"



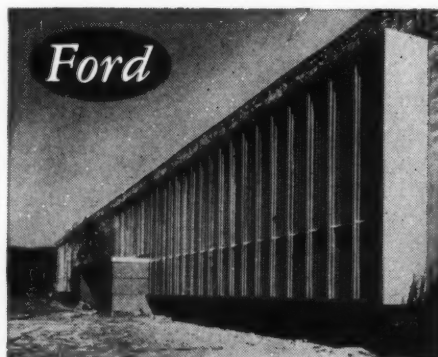
Representatives in Principal Cities

## Marcus TRANSFORMERS

for trouble-free operation and performance beyond specifications

A COMPLETE LINE OF OIL IMMERSSED, ASKAREL,  
AND DRY TYPE TRANSFORMERS up to 5000 KVA

- POWER
- DISTRIBUTION
- UNIT SUBSTATION
- GENERAL PURPOSE
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING
- SPECIAL



Courtesy Newark Evening News  
South front of beautiful, ultra-modern office  
section of new Ford plant at Mahwah, N. J.

**Marcus**  
**TRANSFORMER CO., INC.**  
**RAHWAY, NEW JERSEY**

were available, that would help considerably in Germany, and a French-speaking engineer would be necessary in France.

The American engineering societies, especially those concerned with the consulting profession, should be encouraged to send more of their published literature to Europe for consulting engineers over here. This material could be re-published in local periodicals and would reach a wide and interested audience of working consulting engineers.

#### A Cordial Reception

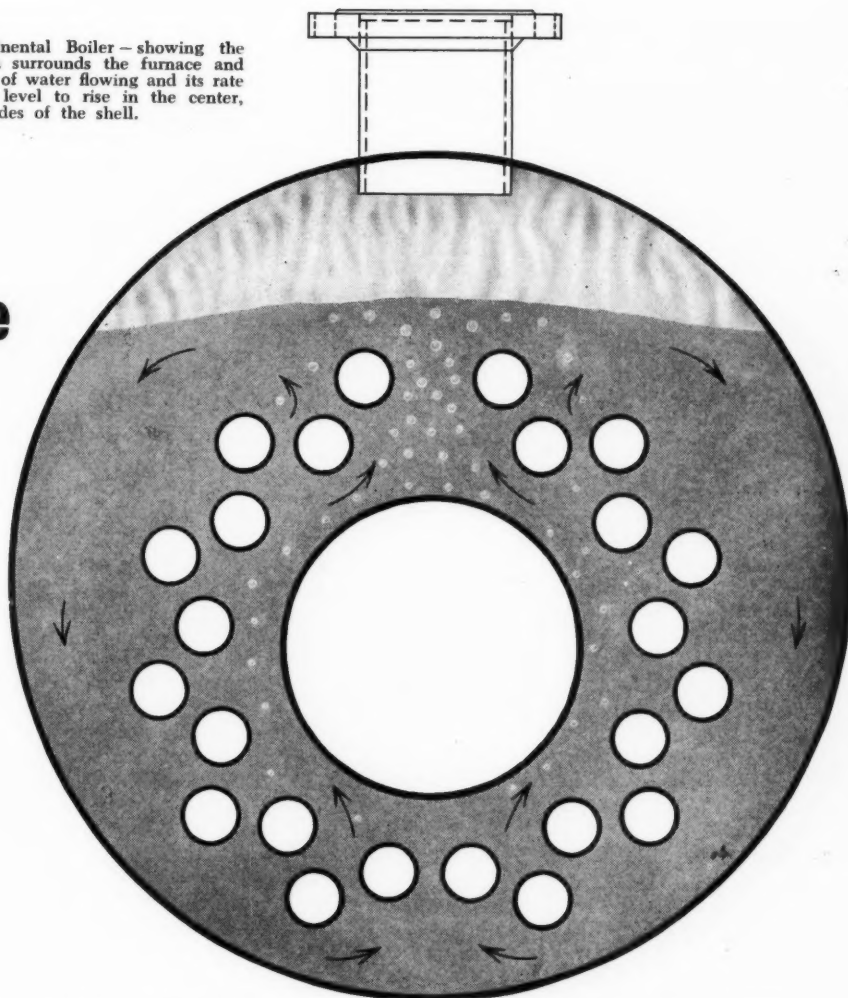
My own experiences indicate that any American consultant who comes over here will receive a very warm and cordial reception. I believe American consultants will be astonished at the ignorance and misunderstanding of American consulting engineering practices in the minds of European engineers. I think they will also be surprised at the integrated and tightly-knit engineering associations in the individual countries and the extent and diversity of some of the private consulting work in the promising foreign development field.

London will be a good starting point in any effort to establish closer ties with European engineers. The British Association of Consulting Engineers is, after all, the earliest of the professional consulting engineering societies. And while in our eyes it may appear that its 400-plus members have some set views on ethics and consulting practices that, to borrow a phrase, are a "bit sticky," Julian Tritton himself is a down-to-earth, friendly, and very reasonable person. He is warm and charming with none of the cold reserve or icy tradition that we so commonly associate with the British. He will win many friends if he comes to the U.S. and will help pave the way for future cooperation and cordial relations between European and American consulting engineers who have common interests. ▲ ▲

CONSULTING ENGINEER

Cross-section of a Continental Boiler—showing the free flow of water which surrounds the furnace and return tubes. The volume of water flowing and its rate of flow cause the water level to rise in the center, then fall away to both sides of the shell.

# What makes the *Continental* Boiler last longer... makes steam cost less



If you were to design a packaged boiler, water circulation would be a basic consideration because . . .

. . . poor circulation can cause overheating . . . can cause unequal stress in metal heating surfaces . . . can promote pitting and scaling on metal surfaces exposed to water . . . and can result in higher stack temperatures, decreased boiler efficiency.

But the many owners of Continental Boilers have had none of these troubles. Here are two special reasons why:

## 1. Two-pass design provides even flow of combustion gases to all heating surfaces.

Heat is thus distributed evenly to the rear tube-sheet and to all of the return tubes. Water is heated uniformly, and natural, balanced circulation results.

If high temperature combustion gases were to enter only one section of the return tube bank, the tubes in that section would be at a higher temperature, would be doing more work than the balance of the tube-sheet

and return tubes. The result: water surrounding those cooler heating surfaces would have sluggish circulation.

## 2. Heating surfaces in the Continental Boiler are arranged so that there is a centrally located furnace and equal spacing of return tubes.

Of the total heat transferred to the water within a Continental Boiler, about 60% is transferred by the furnace. Thus it is essential that flow of water around the furnace be unrestricted. Note the area around and above the furnace and the open channel along both sides of the boiler shell. This design assures unrestricted flow of water around the furnace . . . facilitates rapid flow of water to the bottom of the boiler for reheating.

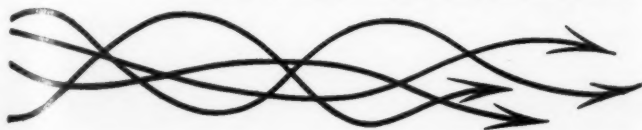
Uniform . . . free . . . rapid water circulation is an important reason why a Continental Boiler costs little to keep, has long service life, and makes steam cost less. For detailed information write for Bulletins BE-3, BE-4.

## BOILER ENGINEERING & SUPPLY COMPANY, INC.

1 Manavon St., Phoenixville, Pa.

CONTINENTAL . . .

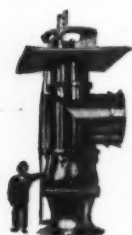
the boiler with the spinning gas technique



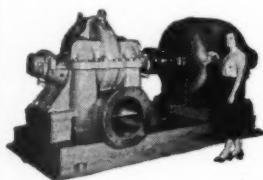
## YOU NAME THE PURPOSE WE MAKE THE PUMP

For every specific need from the smallest to the giants of 200,000 GPM capacity — Highly specialized engineering and manufacturing for over 40 years assures freedom from maintenance worries — Many users report 15 to 20 years service without replacement of major parts.

### WHEELER ECONOMY PUMPS

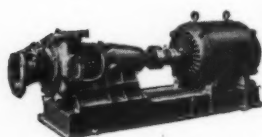


VERTICAL AXIAL  
FLOW FOR  
CIRCULATING  
CONDENSER  
COOLING WATER

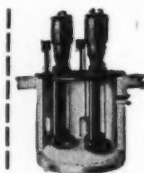


DUAL VOLUTE  
FOR MUNICIPAL  
WATER WORKS

### WHEELER ECONOMY PUMPS

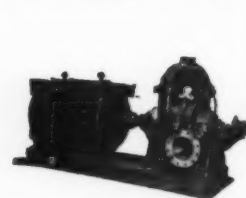


HORIZONTAL  
NON-CLOG FOR  
SEWAGE,  
TRASH, STOCK



DUPLEX, SUBMERGED  
NON-CLOG FOR  
SANITATION  
SEWAGE,  
INDUSTRIAL WASTE

### WHEELER ECONOMY PUMPS



TWO-STAGE DMD  
HIGH HEAD FOR  
MUNICIPAL &  
INDUSTRIAL SERVICE



VERTICAL MIXED  
FLOW FOR  
IRRIGATION,  
DRAINAGE, FLOOD  
CONTROL, SEWAGE

WRITE FOR BULLETINS

WE-500

### WHEELER-ECONOMY PUMPS

ECONOMY PUMPS, INC. • DIVISION OF  
C. H. WHEELER MANUFACTURING CO.  
19TH AND LEHIGH, PHILADELPHIA 32, PA.



## IN ENGINEERING

O. H. Berry and Charles E. Phillips have announced formation of Berry and Phillips, a consulting petroleum engineering firm, which will open September 1. The firm will specialize in evaluation and management of oil and gas properties from its Midland, Texas, offices.

The affiliated firms of De Leuw, Cather & Co., of Chicago and De Leuw, Cather & Brill, of New York City announce that Charles R. Waters has joined their organization as an Associate of De Leuw, Cather & Brill and Special Consultant to De Leuw, Cather & Co. He will be in charge of the Buffalo, N. Y. office.

Walter Sanders, chairman of the department of architecture in the College of Architecture and Design, University of Michigan, has been retained by Albert Kahn Associated Architects and Engineers as a consultant on architectural design.

John T. Parrett announces opening of an office for the practice of consulting mechanical engineering at 431 W. Main St., Benton Harbor, Michigan.

Walter Kidde Constructors, Inc. has established a new subsidiary, Kidde Automation Systems, Inc., to

design, engineer, and build automated warehousing systems. William Collins will be president of the new subsidiary, with Walter L. Kidde as treasurer, P. L. Griffith as general manager and secretary, George Schuck as controller, and David R. Angus as sales manager.

Allstates Engineering Co. announces appointment of R. Charles Jester, Jr. as president and general manager and Emery B. Kerekes as chief engineer and member of the executive committee. N. Bruce Bagger is the new sales promotion and market analyst.

Joseph W. Barker, chairman and president of the Research Corp., New York City, has been nominated to serve as next president of The American Society of Mechanical Engineers. Nominated as regional vice presidents are: Charles E. Crede, Barry Controls, Inc.; Frank W. Miller, Yarnall-Waring Co.; Albert C. Pasini, The Detroit Edison Co.; and Bryan T. McMinn, University of Washington, Seattle.

Dr. Truman S. Gray, associate professor of engineering electronics at MIT, has been named consultant on nuclear energy by the Brown Instruments Div. of Minneapolis-Honeywell Regulator Co.

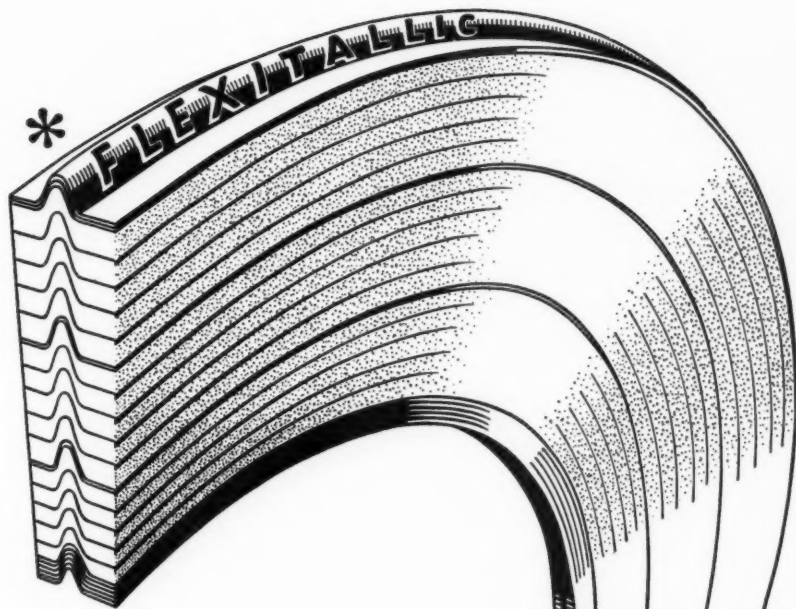
#### DISCUSS ACADEMY

Air Force Academy consultants meeting in Colorado Springs are, L. to R.: E. A. Merrill of Skidmore, Owings & Merrill; A. Windman of Syska and Hennessy; Henry L. Conger, SOM; Lt. Col. B. A. Scarbrough; V. Butler of Moran, Proctor, Mueser and Rutledge; and J. H. Bauer of Robert and Company.



CONSULTING ENGINEER





## DO YOU TAKE GASKETS FOR GRANTED?

In the costly processes of today's industry — where fluids are confined in searing heat and brutal pressures — taking a gasket for granted is serious business. The price of gasket failure is measured in damaged equipment, plant "down-time", danger to personnel.

No one at Flexitallic has ever taken a gasket for granted. Each Flexitallic Spiral-Wound Gasket is engineered to be the right gasket for the right flange for the right seal. For 43 years, Flexitallic has worked toward perfecting this principle. Small wonder more and more engineers are specifying on orders: "Flexitallic — do not substitute".

Each Flexitallic Gasket is designed and engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and un-

predictable joint stresses. Spirally-wound V-crimped plies of required metal with alternating plies of proper filler result in a resilient gasket having characteristics of a calibrated spring.

Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 10,000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". In diameters to 84" O. D.

**FLEXITALLIC GASKET CO.**  
8th & Bailey Sts., Camden 1, N. J.  
*Representatives in principal cities*

*Flexitallic*  
**SPIRAL-WOUND GASKETS**

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

**TEFLON FOR  
PROCESS APPLICATIONS**

The ideal seal for many process applications is a Flexitallic Gasket with Teflon trapped between edges of stainless steel. Ask for folder, "Teflon in Flexitallic Gaskets."

\*Not all spiral-wound gaskets are Flexitallic. Look for *Flexitallic Blue* — it's our exclusive blue-dyed Canadian asbestos filler.

## NEW . . . Jerguson Sight Flow Indicators



*easily and inexpensively  
installed to show movement  
of liquid in pipe lines*

Here is a new line of Sight Flow Indicators . . . easily and inexpensively installed in any new or existing pipe line  $\frac{1}{2}$ " to 2" N.P.T.

The special design of these new indicators results in a turbulence in the flow of liquid, making it easily visible. Several types of indicating vanes, installed within the chamber, may also be furnished, according to variable conditions of rate of flow and viscosity of liquid. For indication of minute flows, small Sight Flow Indicators with a rotating vertical rising ball are available.

Jerguson Sight Flow Indicators are soundly designed, carefully made, and are backed up by a company with over 40 years experience in the field. Available in Transparent and Reflex types, in a wide variety of materials and linings, and with Wedge Type Illuminators, Havg Chambers, Non-Frosting Glasses, or other special construction.

*If you have a problem of viewing the flow of liquid in a pipe line, it will pay you to investigate the new Jerguson Sight Flow Indicators today. Send us your requirements or write for Data Unit.*

# JERGUSON

*Gages and Valves for the  
Observation of Liquids and Levels*

**JERGUSON GAGE & VALVE COMPANY**

**100 Fellsway, Somerville 45, Mass.**

*Offices in Major Cities*

Jerguson Tress Gage & Valve Co., Ltd., London, Eng.  
Pétrole Service, Paris, France

# Notes FROM ABROAD



## "Hot" Marine Gas Turbines

A marine gas turbine to operate at a temperature of 2200 F—nearly twice the presently adopted temperature level—and a thermal efficiency presumably double that of the conventional steam turbine—is being developed at the Pametrada Research Station in England. Through further extensive applications of ceramics and liquid-cooled blading (a practice still little understood) there is reason to believe that gas turbines can be made to reach still higher efficiencies by continuing to raise the operating temperatures.

The staff at the Pametrada Station expects to have a full-scale experimental turbine running before the end of the year. However, the "hot" gas turbine seems to be far ahead of its time and may not find any immediate practical applications. Nevertheless these experiments will focus attention on areas in which research and development can progress to lift the limits of efficiency and long-life operation for gas turbines.

## A Swiss Innovation

Swiss engineers of the firm Luwa A. G. have developed a new unit as part of a system for distributing conditioned air in offices, warehouses, hospitals, and other industrial buildings. The Jettair apparatus has much the same appearance as an ordinary radiator convector. The unit itself is only about 3 in. wide and made up of aluminum sections. It is designed to be mounted along the inside

outer walls of a building, under the window bays.

The upper part of the unit consists of heat exchange elements that are fed with warm water in the winter and cold water in the summer. Primary air—already cleaned by a special filter, pre-heated or pre-cooled, and moistened or dehumidified as desired in a central conditioning plant—is piped to the various Jettair units and injected through special jets into the lower part of each unit. The injection effect causes the secondary air in the room to be sucked in. Primary and secondary air mix in the apparatus and are then returned to the room. Temperature and moisture of air can be automatically regulated.

By using both air and water as mediums to distribute a warming (or cooling) effect, the Jettair system seems to introduce certain advantages. The distribution system carries only the primary (conditioned) air to be added to the air in the room so that neither the central apparatus nor the ducts are charged with circulating air. Therefore the air ductwork can be designed appreciably smaller (5 to 10 times) than would normally be required. No return ducts are necessary. Because the air is sent into the room from under the windows it tends to follow rather than oppose the "natural" convection currents.

## Vibrating Conveyors

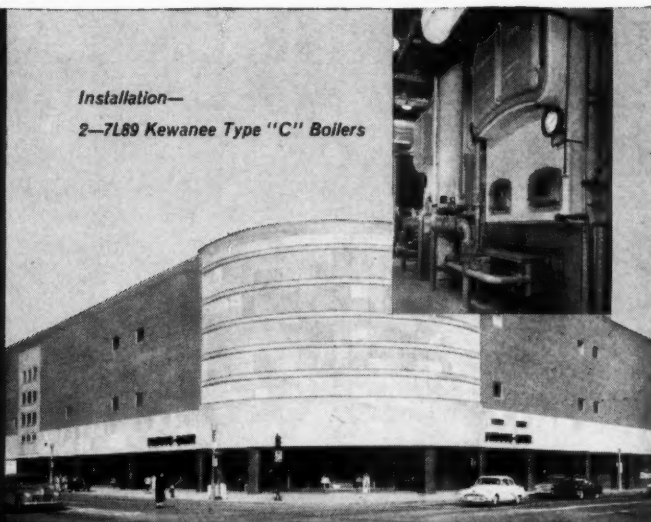
An Austrian firm, Messrs. Ludwig Binder and Co., has developed a series of new vibrating ma-

# Operating-Maintenance Costs Cut with Kewanee Boilers

Noel Spannagel, Chief Engineer,  
Famous-Barr Company

Here are 3 installations of Kewanee  
Boilers at Famous-Barr Company

Installation—  
2—7L89 Kewanee Type "C" Boilers



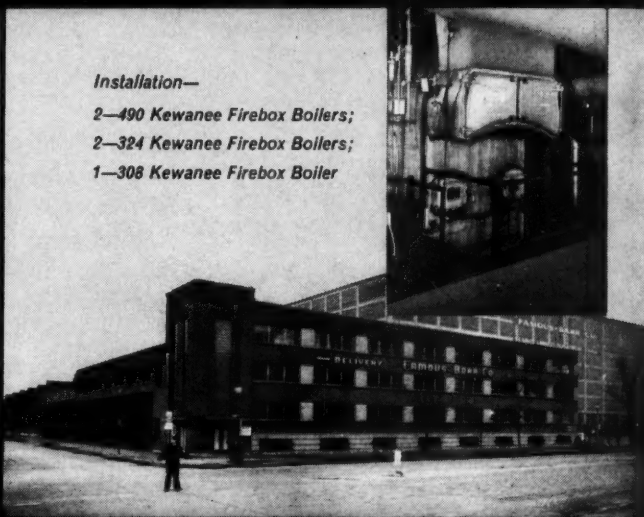
Heating Contractor: Eichler Company;  
Architect: P. J. Hoerner; Engineer: John D. Falvey

Installation—  
2—7L87 Kewanee Type "C" Boilers;  
1—7L82 Kewanee Type "C" Boiler



Heating Contractor: Eichler Company;  
Architect: Russell Mullgardt-Schwarz-Van Houten; Engineer: John D. Falvey

Installation—  
2—490 Kewanee Firebox Boilers;  
2—324 Kewanee Firebox Boilers;  
1—308 Kewanee Firebox Boiler



Heating Contractor: Eichler Company; Architect: Will Levy



## PREFERRED BY FAMOUS-BARR FOR OVER 1/4 CENTURY

Back in 1928 the Famous-Barr Company, St. Louis, installed 2 Kewanee Stoker Fired Boilers in a warehouse . . . so began an experience with Kewanee Boilers that has extended over the past quarter century. As they expanded, as new buildings called for more power, Kewanee was the preferred boiler installation every time. But let Noel Spannagel, Famous-Barr's chief engineer, tell the story:

"My previous experience proved Kewanee offered important savings in operating and maintenance as compared with other boilers."

Famous-Barr long has known the advantages assured by Kewanee Reserve Plus Rated Boilers such as provision for expansion—"cruising

speed" operation which lowers operating and maintenance costs and lengthens boiler life. So when you consider boilers, be sure they are rated on nominal capacity to operate at "cruising speed."

Don't be misled by promises that a boiler delivers steam to meet average daily requirements. Only a boiler rated on nominal capacity can guarantee performance beyond the call of usual duty.



**YOU can depend on KEWANEE engineering**



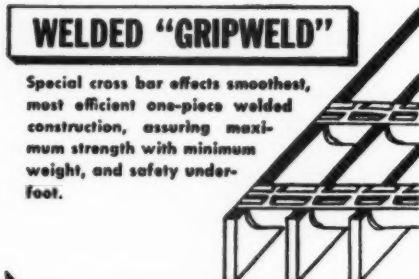
# IRVING GRATING FOREMOST... in

- ★ **ECONOMY**
- ★ **STRENGTH**
- ★ **VERSATILITY**
- ★ **SAFETY**



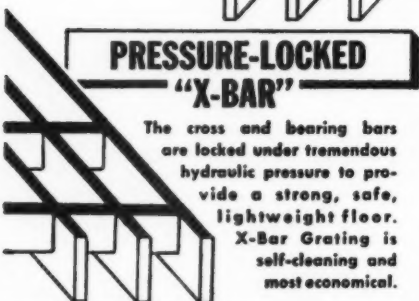
## RIVETED "RETICULINE"

The most substantial grating design made for distribution of heavy loads and rugged needs. Provides maximum traction combined with smoothness for walking, working, wheeling in all directions.



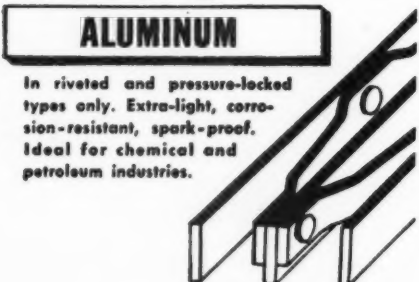
## WELDED "GRIPWELD"

Special cross bar effects smoothest, most efficient one-piece welded construction, assuring maximum strength with minimum weight, and safety underfoot.



## PRESSURE-LOCKED "X-BAR"

The cross and bearing bars are locked under tremendous hydraulic pressure to provide a strong, safe, lightweight floor. X-Bar Grating is self-cleaning and most economical.



## ALUMINUM

In riveted and pressure-locked types only. Extra-light, corrosion-resistant, spark-proof. Ideal for chemical and petroleum industries.

Ask for Illustrated Catalog

**IRVING SUBWAY  
GRATING CO., INC.**

ESTABLISHED 1902

OFFICES and PLANTS at  
5056 27th St., Long Island City 1, N. Y.  
1851 10th St., Oakland 20, California

chines for conveying, screening, drying, dispersing, and otherwise handling bulk materials. The application of new designs and modern lightweight construction has considerably increased efficiency and economy of these machines.

The design of the new machines is based on the principle of two masses swinging in resonance. The two principal parts of the conveyor are arranged one on top of the other and are connected by flat steel springs (resonance springs). The system, which is equipped with guides and guide supports, is put into vibration by a double eccentric drive. The flat steel springs are arranged in such a way that according to their number, spring constants, and position, the force of the mass is absorbed and practically no force or momentum is transmitted to the supporting elements. Due to the reciprocating action of the swinging masses the driving power required is small.

Since the resonance drive requires comparatively little driving energy, the vibrating machines can now be constructed in sizes and lengths that were not feasible before. The forced drive ensures an even progress of the material to be conveyed or screened and a minimum amount of wear between the moving parts. Consequently, the servicing requirements are very reasonable. The machines can be used as conveyors as well as screens or as both at the same time. They can be installed without foundations, even on a light wooden base. The versatility of the vibrating machine system gives it a wide range of applications in industry.

As an example of a specific application, a vibrating tube conveyor for the transport of hot cement clinker with a capacity of 180 tons per hr was constructed for an Italian cement factory. The unit is approximately 250 ft long with a tube diameter of about 17 in. and uses a 10 hp motor drive. The vibrating trough conveyors have been found to be

most efficient for processes where the material is to be charged, observed, or treated continuously.

## Cosmic Ray Telescope

A cosmic ray geiger counter telescope invented by Dr. E. P. George, Director of Experimental Research, at the University of Sydney School of Physics, will save many thousands of dollars in the construction of tunnels in the Snowy Mountains Hydro Electric Scheme, in southern New South Wales, Australia.

The instrument is used to measure the weight of earth above tunnels. It has been tested successfully at the invitation of the Snowy Mountains Hydro Electric Authority. The Authority now proposes to use it for testing tunnels that are already under construction.

Dr. George's instrument consists of 100 Geiger counter tubes three feet long mounted in four opposed banks of 25, several hundred pounds of lead, and a recording apparatus fed from the Geiger counter tubes through electrical wiring. The whole apparatus is mounted on wheels and can be rolled inside the tunnel whose overburden has to be calculated.

It is necessary to calculate the weight of earth above a tunnel to predict the manner in which water will eventually flow through it. Usual practice is the direct method of estimating density of the overburden from samples obtained by boring. This is very costly, involving thousands of feet of expensive drilling. The new method is far less expensive and more accurate.

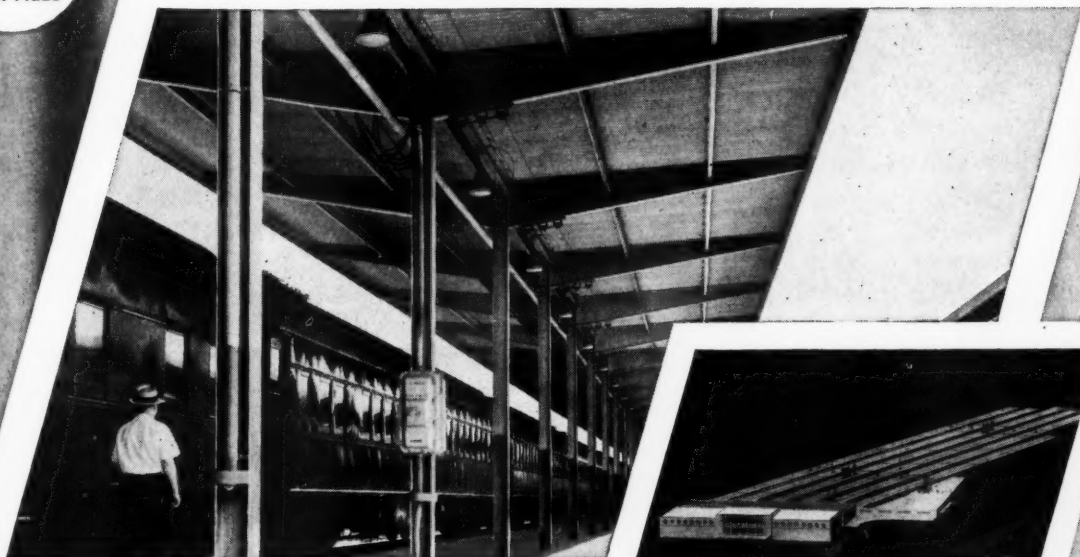
Inside the tunnel, Dr. George's instrument records the amount of penetration by cosmic rays. This amount of penetration is compared to the cosmic radiation at the same altitude outside the tunnel. From this, the amount of resistance to cosmic rays above the tunnel is calculated, and the weight of the overburden decided.

Work on the Snowy Mountains Scheme began in August, 1949.

CONSULTING ENGINEER

# ANOTHER NEW IDEA...

ONE OF A  
SERIES OF  
IDEAS FOR  
YOUR FILES

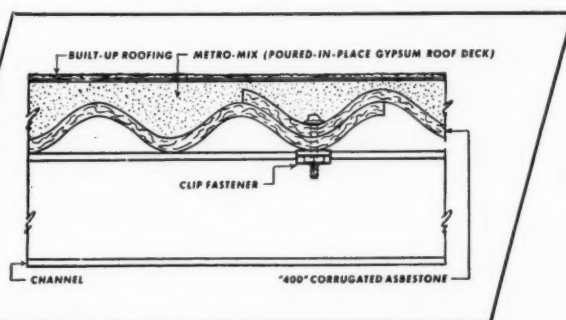


## WITH CORRUGATED ASBESTONE

### *Corrugated Asbestone teams up with gypsum on these fireproof, corrosion-resistant platform shelters*

Train shed roofs in New Orleans' new Union Passenger Terminal will stand up against corrosion and weather year after year. They're made of fireproof Gold Bond Corrugated Asbestone "400" topped with poured gypsum roof deck. They're as good looking as they are practical... natural light and shadow lines are formed by the texture. And rock-like asbestos and gypsum need no upkeep.

How many uses can *you* think of for Gold Bond Corrugated Asbestone? Wherever you use it, you're getting lasting strength and good looks. Write for details on this unique Gold Bond construction system. Address Dept. CE-95, National Gypsum Company, P. O. 5257-B, New Orleans 15, La.



NATIONAL GYPSUM COMPANY • BUFFALO 2, NEW YORK

**Build better with  
Gold Bond**



LATH, PLASTER  
AND LIME



GYPSUM BOARD  
PRODUCTS



INSULATION BOARDS  
PLANKS AND TILES



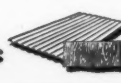
ROCK WOOL  
INSULATION



PAINTS AND  
TEXTURES



ACOUSTICAL  
TILES



ASBESTOS ROOFING  
AND SIDING

... CORRUGATED ASBESTONE

The first hydro-electric project has just been completed, and more work is now in the hands of the contractors. Men and women of 32 nations are teamed up on the roof of Southern Australia in one of the biggest engineering jobs now in progress anywhere in the world. Power will be supplied to 17 new power stations in New South Wales when three dams in the Snowy Mountains are completed.

The largest dam, at Adaminaby, will hold nine times the weight of water in Sydney Harbor. The weight of this water will shift the center of the earth (theoretically at least) by a quarter of an inch.

Soil tests have yet to be made for the big dam at Adaminaby which will be one of the biggest earth and rock dams in the world, half a mile across the top.

The scheme involves the construction of 85 miles of tunnels. One tunnel 30 miles long will run 3000 feet below the mountain tops

at the base of Mount Kosciusko and will have a power station built 1000 feet underground.

#### Mapping from the Air

The air photographic division of K.L.M. (Royal Dutch Airlines) has started air-mapping work in Dutch New Guinea. By order of the Government of New Guinea, the area around Merauke (on the south coast) will be mapped out (scale 1:25,000) in preparation of an important irrigation scheme in that district. This will be followed by a second, considerably larger project: the mapping out (scale 1:40,000) of the Lake Plain (north of the central mountains). The two areas together cover about 29,100 sq miles.

#### Construction Abroad

South Korea will enjoy a higher standard of living when major additions to that small nation's electric power system are placed in operation early next year. The

first of four new General Electric 25,000 kilowatt steam turbine-generators recently was loaded aboard the U.S. Lines ship, Pioneer Sea, for shipment to the Far East. Although the 100,000 kw total is small by U. S. standards, it will supply more than half of South Korea's commercial, residential, and industrial electric power needs.

Previously ninety percent of South Korea's power was supplied from plants above the 38th parallel. After this power supply was cut off in 1947, the country relied on two American military power-generating barges, which together with four hydro and three thermal stations produce all the power for South Korea.

Bechtel Corporation, engineers and constructors with headquarters in San Francisco, is designing and constructing these stations for the government of Korea with financing supplied through the mutual security program now administered by the International Cooperation Administration of the Department of State.

Stone & Webster Engineering Corporation has a contract from British Petroleum Chemicals Ltd., for the design and construction of ethylene, ethanol, and tetramer units costing approximately \$13,000,000, at Grangemouth, Scotland. These new high capacity, high efficiency units are an expansion of the company's original petrochemical plant completed in 1951. It was also designed and constructed by Stone & Webster and its subsidiary, E. B. Badger & Sons Limited.

Catalytic Construction Company, of Philadelphia, has been awarded a contract for complete process engineering design data, under Esso Research and Engineering Co. patents, for the construction in Marl, West Germany, of a cuprous ammoniacal acetate purification system to handle 40,000 tons per year of butadiene in conjunction with a single-step Houdry Dehydrogenation unit.



These four 30' x 60' silos are used by a pulp and paper mill for handling and storing wood chips.

We have erected silo-type bins at hundreds of plants to handle and store bulk materials peculiar to their industries. A few examples are—grain for the milling industry; clay, silica sand, and feldspar for the ceramic industry; ore for the metal

industries; molding sand for the foundry industry; cottonseed and soybeans for the vegetable oil industry.

Designing handling and storage systems for around 100 kinds of materials has given us a wealth of experience which is at your disposal. You are invited to write, wire, or phone us.

*Not exported except to Canada and Mexico*

**THE NEFF & FRY CO.**  
302 ELM STREET • CAMDEN, OHIO

SUPER-CONCRETE STAVE  
STORAGE BINS

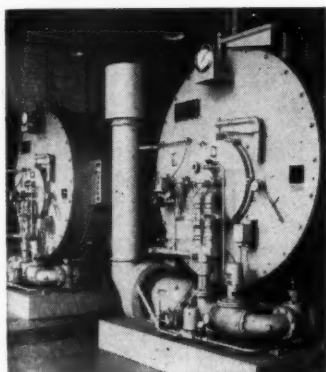
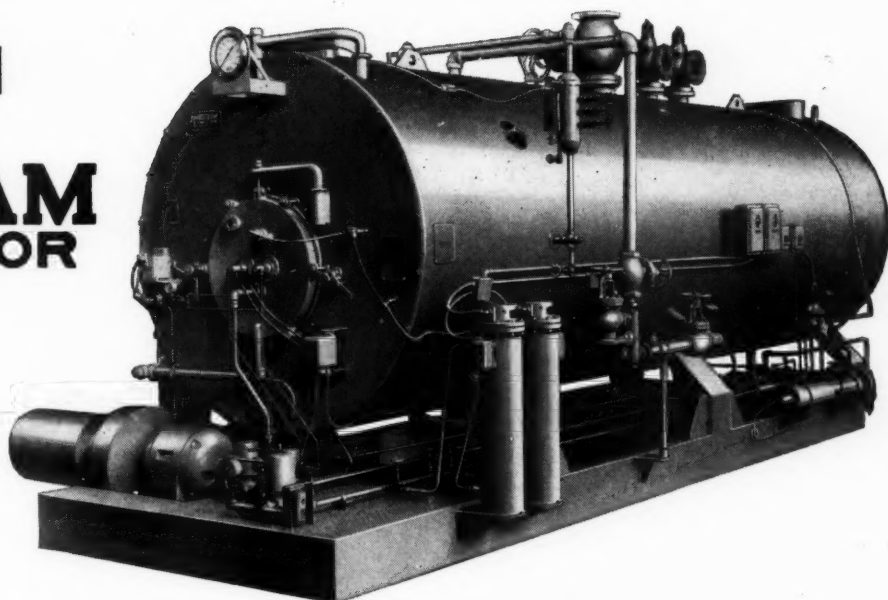


# GET **ALL** THESE ADVANTAGES

## WITH AN **AMESTEAM** GENERATOR

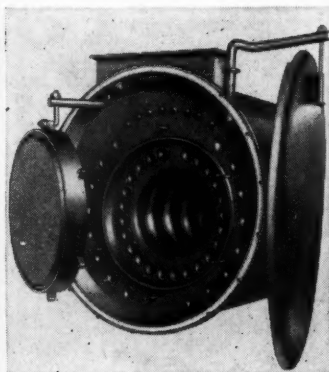
For:  
**PROCESSING  
HEAT — POWER**

20 sizes, 10 to 600 H.P., 15 to 200#  
W.P., oil, gas or oil-gas combina-  
tions with quick fuel switchover  
feature.



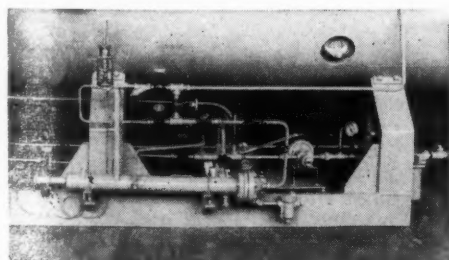
### FULLY ASSEMBLED

All piping, wiring and operating  
parts completely assembled and  
tested at factory — units shipped  
in ready-to-fire condition!



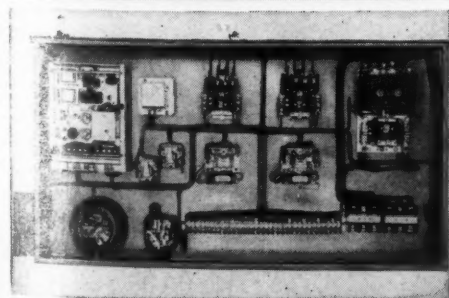
### EASY TO CLEAN

Ames-designed davit hinged flue  
covers and baffle provide quick  
and complete access to the furnace  
and all tubes.



### AMPLE ROOM

underneath for ser-  
vicing auxiliary  
equipment. Control  
panel at eye level.



### AUTOMATIC

operation, fully  
safeguarded, is pro-  
vided by factory  
installed and tested  
control system.

### SAVINGS IN FIRST COST!

Your purchase price includes complete unit — no  
hidden "extras" to buy later on!

### SAVINGS AT INSTALLATIONS

Just set on level concrete floor, connect to service  
lines and breeching. Nothing to assemble. No  
brick work required.

### SAVINGS IN OPERATION

A minimum of supervision — lower manhour  
requirements for maintenance — easily replaced  
inexpensive plastic refractories — 80% thermal  
efficiency.

Write for bulletin today!

**AMES IRON WORKS, INC.**  
Oswego, N. Y., Box P-95

Gentlemen:

Please send me further information on AMESTEAM  
GENERATORS and name of nearest representative.

NAME.....

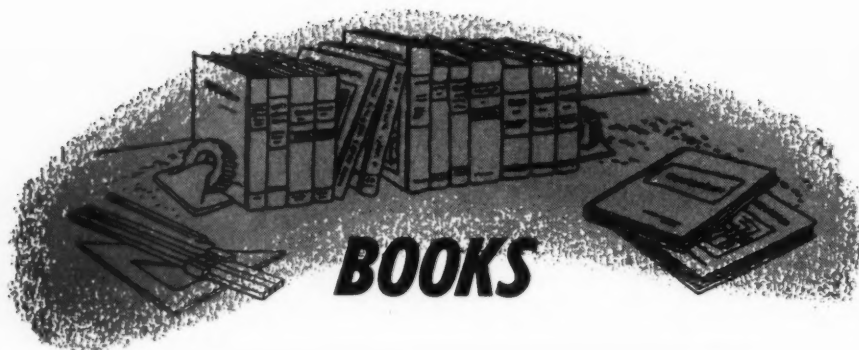
COMPANY.....

ADDRESS.....

# **AMES IRON WORKS INC.**

BOX P-95

OSWEGO, N. Y.



### TO ORDER BOOKS

As a readers' service, CONSULTING ENGINEER will order reviewed books or any other technical volumes you need. In ordering books, give title, author, and publisher and enclose check. We will also suggest titles of books on any technical subject and order for you at regular publishers' prices.

**FIBERGLAS REINFORCED PLASTICS**, by Ralph H. Sonneborn, Albert G. H. Dietz, and Alton S. Heyser; Reinhold Publishing Corp.; 240 pp; \$4.50.

*Reviewed by Frank Charity,  
Consulting Engineer*

The ten chapters of this book cover design considerations, manu-

facturing methods, inspection procedures, physical properties, and applications pertaining to Fiberglas reinforced plastics (FRP). The design data (by Messrs. Dietz and Heyser) should alone make the volume a worthwhile addition to the library of any plastics engineering consultant, since the basic theories



## How to protect workmen from DUST HAZARDS in industry

**JUST OUT!**

**T**HIS book covers the problem of dust control in its relation to the health of workmen, emphasizing the cooperative nature of the problem for engineers and physicians, and presenting principles, methods, and data for the design and operation of dust-control equipment. It describes the physical aspects of dust and fume suspensions and their effect upon man; shows how to analyze and measure fine dusts; and covers the practical and design aspects of dust-control apparatus and use of respiratory protective devices.

## INDUSTRIAL DUST

*Hygienic Significance,  
Measurement and Control*

by **PHILIP DRINKER**

Professor of Industrial Hygiene, Harvard School  
of Public Health

and **THEODORE HATCH**

Professor of Industrial Health Engineering,  
Graduate School of Public Health, University of  
Pittsburgh and Research Adviser, Industrial  
Hygiene Foundation, Mellon Institute

**Second Edition, 371 pages, 6 x 9,  
148 illustrations, \$10.00**

Mail your order to

**CONSULTING ENGINEER**

227 Wayne Street

St. Joseph, Mich.

**F**ROM this book both engineers and physicians can get help in handling their own aspects of the industrial dust problem in effective relation to the work of the other. The hygienic significance of the problem and the fundamentals and methods of measurement, analysis, and control are blended in a way to show well-rounded, effective practice.

Throughout the treatment, facts are clearly stated and supported by many usable charts and graphs. Emphasis is given to advances in control experience, and the considerations that will help the reader engaged in practical investigation and remedial work in this field.

### CONTENTS

Physical Properties of Dust, Fumes, and Mists. Effects of Dusts and Fumes upon Man. Inert and Toxic Dusts. Physical and Chemical Factors in Pneumoconiosis. Dust Retention by Man. The Dusty Trades. Appraisal of Dustiness. Determination of Dust Concentration. Determination of Particle Size. Chemical and Mineralogical Analysis of Dust. Methods for the Control of Industrial Dust. Design of Local Exhaust Systems. Air Cleaning. Air Cleaning by Filtering, Scrubbing and Electrical Precipitation. Dust Respirators and Air Masks.

associated with the use of FRP are now well-established and should undergo few (if any) changes over a period of many years.

In view of the fact that new FRP materials and processing methods are being developed almost daily, it would be impossible at present to write a thoroughly practical book on this subject that would remain complete and up-to-date for any great length of time. Nevertheless, Mr. Sonneborn's contribution to the volume is likely to remain the most comprehensive treatise of its type for several years to come.

It is perhaps regrettable that Mr. Sonneborn is an employee of Owens-Corning Fiberglas Corporation, since his presentation would be improved if it did not give the impression that Fiberglas is the only line of glass fiber products. However, his emphasis on Fiberglas is excusable on the grounds that his experience precludes discussion of other products without some degree of prejudice. And, in all fairness, it should be noted that the Fiberglas line does include the great majority of glass fiber products now being manufactured and sold in the United States.

The illustrations in the book are exceptionally good. In addition to photographs, they include a large number of diagrams and tables which should do much to make the text understandable and interesting to laymen as well as to experienced plastics engineers. One series of illustrations, for instance, shows the step-by-step operations that are essential to the manufacture of FRP automobile bodies. Other sequences show how FRP materials are continuously extruded, compression molded, and otherwise processed.

A glossary, bibliography, and index should facilitate use of the book for reference purposes.

**THE NATION LOOKS AT ITS RESOURCES**, Report of the Mid-Century Conference on Resources for the Future; Resources for the Future, Inc.; 418 pp; \$5.00.

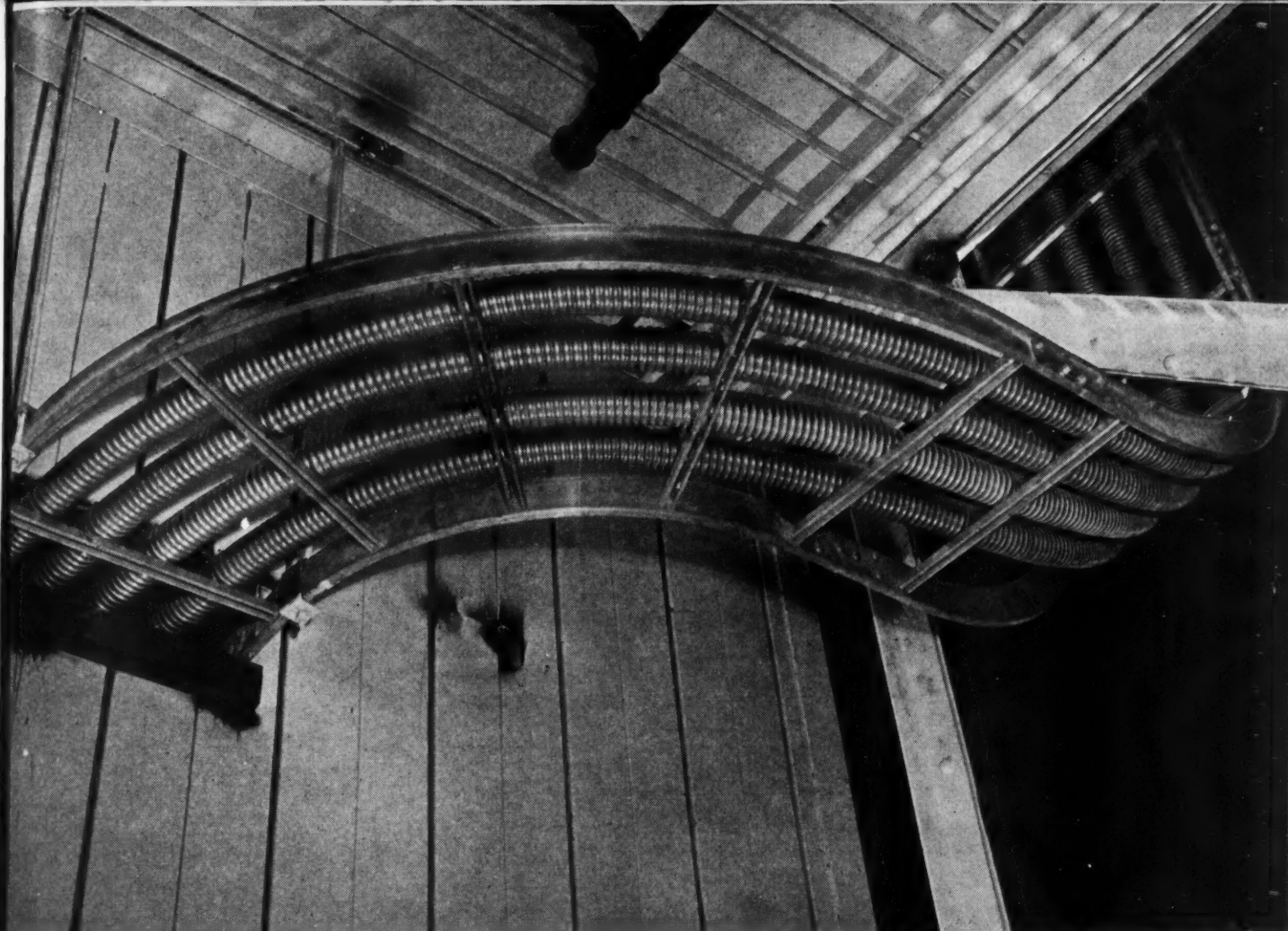
*Reviewed by Dr. Gerald J. Matchett  
Illinois Institute of Technology*

This volume is a report of a three-day conference sponsored by Resources for the Future, Inc.—an organization that received its original impetus and funds from the Ford Foundation in the fall of 1952. The participants and sponsors, 1600 in number, constitute an impressive array of individuals. They are leaders in business, farm, and labor organizations, directors of planning and conservation societies, consulting engineers, representatives of government agencies, and the like.

The theme of the Conference was the mounting pressure to which our natural resources are being subjected as a result of (1) a rapidly



are  
uid  
ver  
  
RP  
ods  
, it  
to  
on  
m-  
eat  
Mr.  
ol-  
ost  
for  
  
Mr.  
ns-  
n,  
m-  
m-  
nly  
er,  
ex-  
ex-  
of  
de-  
ir-  
he  
eat  
ow  
he  
  
are  
to  
ge  
ich  
ext  
to  
ed  
il-  
he  
es-  
RP  
es  
n-  
on  
n-  
ok  
  
E-  
ry  
he  
e,  
  
ott  
  
E-  
e-  
al  
d  
ne  
in  
rs  
y-  
i-  
nt  
  
as  
ur  
y  
  
R



**ANACONDA INTERLOCKED-ARMOR** Cable is installed on simple racks and eliminates the need for conduit. Installation work is finished often in half the time required for other cables.

*Instead of installing cable plus conduit...*

## Cut installation time and cost with cable with its own inbuilt flexible conduit!

When you expand or relocate your power feeders, Anaconda Interlocked-Armor Cable puts you into *full* operation days—sometimes weeks—sooner.

Because it is made with its own tough yet flexible armor, Interlocked-Armor Cable is installed without conduit. Installation time and costs are slashed.

It is laid quickly—indoors or out—on light, easily installed racks. It is

trained smoothly around corners, columns and other obstructions in *long, uninterrupted* runs. And this cable's metal tape armor affords high protection against damage.

Available in multiconductor construction in sizes No. 6 Awg to 750 Mcm—varnished-cambic insulation up to 15 kv—Underwriters' approval for 600 volts and 5000 volts. Also available with rubber or plastic types of

insulations.

Why not talk to the Man from Anaconda about modern, practical Interlocked Armor Cable today? Or, for information, write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

55281

# ANACONDA®

**METALWORKING PLANT** expands its power system with Anaconda Interlocked Armor Cable (1). Cable drops from ceiling (2) from transformer on floor above, and spreads out (3) carrying more power to local centers (4).





growing population, (2) a rapidly expanding domestic market, (3) the ever-present military demand for equipment and material, and (4) the foreign aid program. It should be emphasized that the Conference did not pretend to develop a program or endorse a line of action. The goal of the Conference was to create interest in resources problems and to disseminate expert and informed opinion on the subject.

The subject matter was divided into eight major sections, each of which was further organized into sub-sections. Several of these sections contain information that would be of interest to a consulting engineer. Individuals interested in problems of plant location, decentralization, and transportation will find of value the two sections dealing with land utilization. Those interested in energy problems, including the possibility of the use of atomic energy, will find useful the sections devoted to water resource and energy resource problems. Other interesting sections deal with minerals and resources research.

One defect of this publication is that a number of pages are devoted to replies of three and four sentences to rather narrow questions formulated by sub-section discussion leaders. Frequently this technique

results in assertions of a point of view by the participant with little effort to substantiate an opinion or to develop a line of reasoning.

**MODERN CHEMICAL PROCESSES** — Vol. III, by the Editors of *Industrial and Engineering Chemistry*; Reinhold Publishing Corp. 276 pp; \$5.00.

*Reviewed by Gabriel Appleman*  
Project Engineer  
Foster D. Snell, Inc.

This book, the third of a series, is a collection of the "Staff-Industry Collaborative Reports" on chemical industry which have appeared in *Industrial and Engineering Chemistry* during the years 1952 and 1953.

This series will prove of value as a reference source to chemists, engineers, and executives who do not have convenient access to bound volumes of *Industrial and Engineering Chemistry*. The articles are an excellent starting point for library research in a wide range of chemical processes. The treatment given is more thorough than that available in standard reference works on chemical industry, and bibliographies are included as a guide to further information sources.

There is no apparent system upon which processes have been selected

for treatment. Since the work is essentially an anthology, the order in which the articles appear is that in which they were originally published in magazine form. An alphabetical index is helpful in locating specific information.

Considerable operating data as well as, in many cases, types and sizes of equipment are presented. Generally, only one process is described for each material manufactured. For example, the article entitled "Chlorine and Caustic in Italy" deals largely with the De Nora Amalgam Cell, while the Mathieson Mercury Cell is discussed under the heading "Mercury Cell Chlorine and Caustic." Other cells are not considered at all.

This volume and, in fact, the entire series should prove a valuable addition to school and consultant libraries and a useful auxiliary textbook for students of chemical industry. It will have only limited value to the operating engineer or in a plant library.

## ALSO AVAILABLE

**HOW TO ORGANIZE AND OPERATE PHOTOGRAPHIC SERVICE DEPARTMENTS**, Eastman Kodak Co.; 60 pp; 50¢

This book discusses facilities, organization, and administration of a photographic service department and includes information on space requirements and functions, camera equipment necessary, personnel, position in the parent organization, department accounting, pricing, and equipment amortizing. A check list is provided for evaluating services and three possible organization structures are outlined.

## FILMS

"THE ORTHOFLOW FLUID CATALYTIC CRACKER," The M. W. Kellogg Co., 16 mm, sound and color, 15 minutes.

By animation this film gives a graphic description of the various types of catalytic cracking units and how the older types were improved until we have the efficient units that are in operation today.

"THE SKY'S THE LIMIT," Unistrut Products Co., sound and color, 16-mm, 23 minutes.

This film shows application and use of metal framing in the electrical, mechanical, and materials handling fields. It gives new and different applications of metal framing in other fields also and takes a look into the future where Unistrut framing is applied to the construction of an entire city. ▲▲

## Putting into your hands... the best practice in PLAIN and REINFORCED CONCRETE design



**H**ERE'S a book to help you make the most of today's design methods and techniques in using reinforced concrete for many types of structures. It gives you an understanding of how reinforced concrete members actually behave under stress . . . how to stress analyze various members and parts of structures . . . and how to apply the provisions of the ACI building code.

5th Ed.—Urquhart and O'Rourke

## DESIGN of CONCRETE STRUCTURES

By **LEONARD CHURCH URQUHART**

*Porter, Urquhart & Beavin*  
Consulting Engineers

and **GEORGE WINTER**

*Professor and Head of Department of*  
*Structural Engineering, Cornell Univ.*

**Fifth Edition, 508 pages, 6 x 9,  
204 illustrations, \$7.50**

Mail your order to  
**CONSULTING ENGINEER**  
227 Wayne Street St. Joseph, Mich.

You'll find the book valuable for comparing your methods against those found most useful by others, in picking up new techniques to save you time and work, for understanding and using some of the developments in concrete design, and designing for newer types of concrete construction.

As in its previous editions, this book develops the theory of concrete design by means of realistic problems. Complete designs of some of the more common structures are given to bring together fundamentals in a practical application. This edition takes into account the many changes that have occurred in design codes . . . newer techniques such as ultimate design . . . and covers prestressed concrete.

### CONTENTS

Plain Concrete. General Properties of Reinforced Concrete. Beams and Slabs. Columns. Bending and Axial Stress. Continuous Beams and Frames. Footings. Reinforced Concrete Buildings. Retaining Walls. Arches. Slab, Beam, and Girder Bridges. Modern Developments in Concrete Design. Appendix.